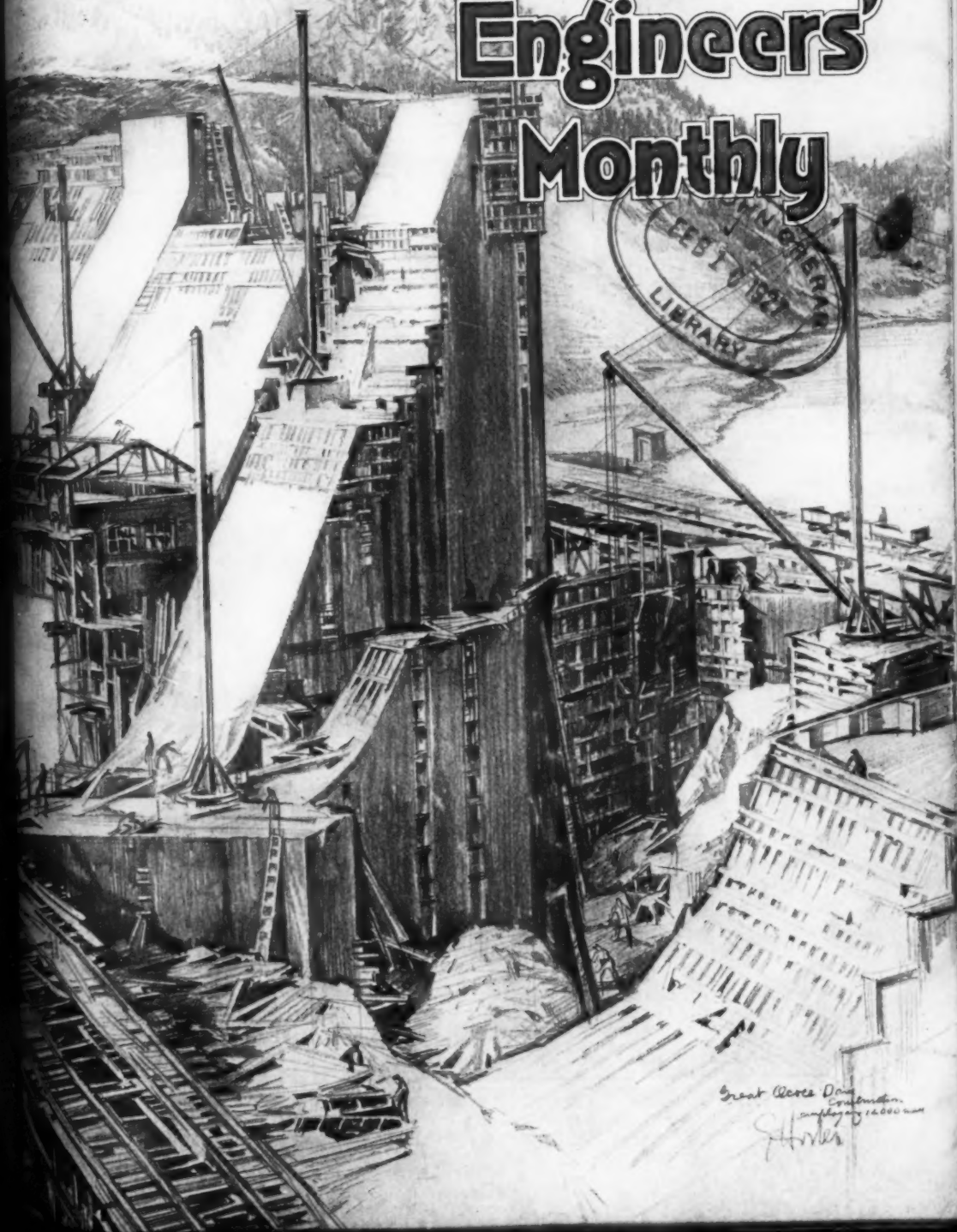


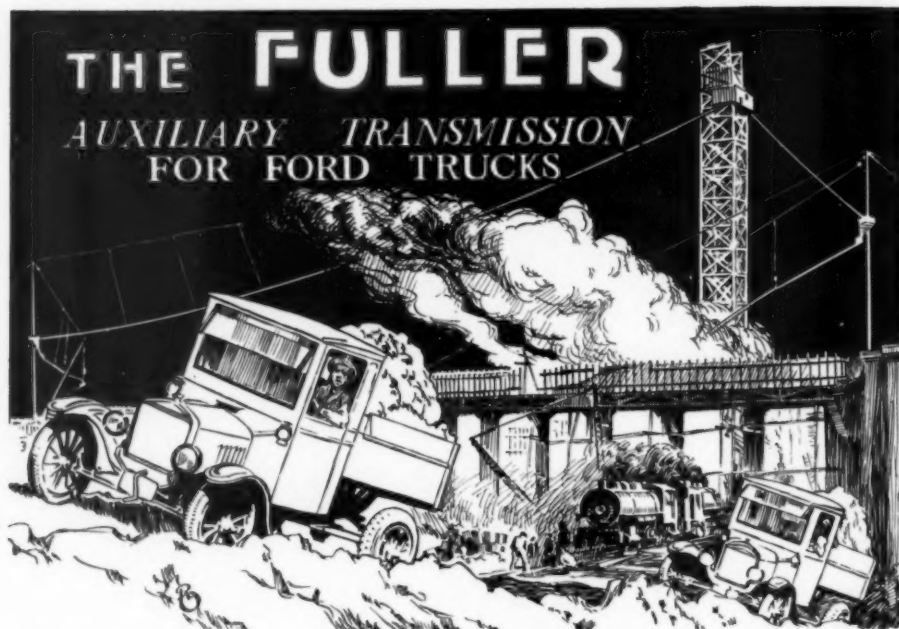
62
FEBRUARY, 1927
25 Cents \$1 a Year

Contractors' *and* Engineers' Monthly



Great Across Dam
Construction
employing 12,000 men
H. M. S.

TWO-TON HAULING CAPACITY AND LONGER TRUCK LIFE



THE FULLER Auxiliary Transmission increases the flexibility, hauling capacity and economy of the Ford One-Ton Truck, and by decreasing the strain on the driving mechanism, prolongs the truck's life.

This unit gives the truck four speeds forward and two reverse, with 80 per cent more pulling ability when in double low.

Installed at the rear end of the drive shaft, it imparts its tremendous leverage direct to the rear axle and wheels. The work of the extra strong rear axle is in-

creased, and the strain on motor, transmission, universal joint and drive shaft is lightened.

The result is greater freedom from the expense and lost time of speed-band replacement, smaller depreciation, and substantially lengthened truck life.

With all its advantages, this unit is so simple in design that it sells for only \$60. You can equip with it at a cost entirely in keeping with the original low cost of your Ford Trucks. SEE YOUR FORD DEALER.

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TRANSMISSION BUILDERS FOR 24 YEARS

PRICE \$60⁰⁰ F. O. B. FACTORY

\$5.00 Additional West of Rockies

VOL. XIV. No. 2 CONTRACTORS' & ENGINEERS' MONTHLY February, 1927
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Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment. The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the **CONTRACTORS' & ENGINEERS' MONTHLY**. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

This index is published as an aid to the reader, but the publishers assume no responsibility for errors or omissions.

AERIAL WIRE ROPE TRAMWAYS

*Amer. Steel & Wire Co., Chicago
Broderick & Bascom Rope Co., St. Louis
A. Leschen & Sons Rope Co., St. Louis

AIR COMPRESSORS

*American Steam Pump Co., Battle Creek, Mich.
Barnes Mfg. Co., Mansfield, O.
*Bell Co., Chicago
*Curtis Pn. Mch. Co., St. Louis, Mo.
*Domestic Eng. & Pump Co., Shippensburg, Pa.
*Hove Engine Co., Lansing, Mich.
*O. K. Clutch & Mach. Co., Columbia, Pa.
*Stover Mfg. & Eng. Co., Freeport, Ill.
*Sullivan Mch. Co., Chicago
*Allis-Chalmers Mfg. Co., Milwaukee.
Chicago Pneumatic Tool Co., N. Y.
De Laval Stm. Turb. Co., Trenton, N. J.
Fairbanks, Morse & Co., Chicago.
Gardner Governor Co., Quincy, Ill.
General Elec. Co., Schenectady, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Independent Pneum. Tool Co., Chicago.
Ingersoll-Rand Co., N. Y.
Kordberg Mfg. Co., Milwaukee.
Norwalk Ir. Wks. Co., So. Norwalk, Ct.
Schramm, Inc., West Chester, Pa.
United Iron Wks., Kans. City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Werthington Pump & Mch. Corp., N.Y.

ARC LAMPS

General Elec. Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARTESIAN WELL DRILLS & PUMPS

Am. Well Works, Aurora, Ill.
Ingersoll-Rand Co., New York.

ASBESTOS PRODUCTS

*Phillip Carey Co., Cincinnati.
Kearney & Mattison Co., Ambler, Pa.
Mikessell Bros. Co., Wabash, Ind.
Norristown Mag. & Asb. Co., Norristown, Pa.
Ball Mountain Co., Chicago.

ASH HANDLING MACHINERY

*Bay City Dredge Wks., Bay City, Mich.
*Byers Mach. Co., Ravenna, O.
*Chain Belt Co., Milwaukee.
Chicago Automatic Conv. Co., Chicago.
*Geo. Hains Mfg. Co., N. Y.
*Mack Trucks, Inc., N. Y.
*Mead-Morrison Mfg. Co., E. Boston, Mass.
*Lakewood Eng. Co., Cleveland, O.
*Link-Belt Co., Chicago.
*Orton Crane & Shovel Co., Chicago.

Atia-Corp., New York.

C. O. Bartlett & Snow Co., Cleveland, O.
Brown Hoisting Mach. Co., Cleveland, O.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., E. Chicago, Ind.
Jeffrey Mfg. Co., Columbus, O.
Portable Mach. Co., Passaic, N. J.
Robins Conv. Belt Co., N. Y.
Jas. B. Seaverns Co., Batavia, Ill.
Webster Mfg. Co., Chicago.
Weller Mfg. Co., Chicago.

ASPHALT

*Barber Asphalt Co., Philadelphia.
*Bartlett Co., N. Y.
*Standard Oil Co. (Ind.), Chicago.
*Standard Oil Co. (N. Y.), N. Y.
*Warren Bros. Co., Boston.
Atlantic Ref. & Asph. Corp., Phila.
Gulf Refining Co., Pittsburgh.
Ky. Rock Asph. Co., Louisville, Ky.
New Orleans Ref. Co., New Orleans.
Pioneer Asph. Co., Lawrenceville, Ill.
Sinclair Ref. Co., Chicago.
Standard Oil Co. of Cal., S. Francisco.
Standard Oil Co. of La., N. Orleans.
Standard Oil Co. of N. J., Newark.
Texas Co., N. Y.

ASPHALT BLOCK

Hastings Pavement Co., N. Y.

ASPHALT CUTTERS

*Littleford Bros., Cincinnati.
*Sullivan Machinery Co., Chicago.
Chicago Pneumatic Tool Co., N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Dayton Pneum. Tool Co., Dayton, O.
Independent Pn. Tool Co., Aurora, Ill.
Ingersoll-Rand Co., N. Y.

ASPHALT KETTLES (See Kettles for Asphalt and Tar Heating)

ASPHALT PLANTS, TOOLS, ETC.

*Aeroli Burner Co., Union Hill, N. J.
*Barber Asphalt Co., Philadelphia.
*Chausse Oil Burner Co., Elkhart, Ind.
*Littleford Bros., Cincinnati, O.
*Warren Bros. Co., Boston.
F. D. Cummer & Son Co., Cleveland, O.
J. D. Farasey Co., Cleveland, O.
Hetherington & Berner, Indianapolis.
Mosher Mfg. Co., Chicago, Ill.

ASPHALT ROLLERS (See Road Rollers)

ASPHALT SURFACE HEATERS

*Aeroli Burner Co., Union Hill, N. J.
*Barber Asphalt Co., Philadelphia.
*Chausse Oil Burner Co., Goshen, Ind.
*Equitable Asp. Maint. Co., Kan. C., Mo.
Hauck Mfg. Co., B'klyn, N. Y.

BACKFILLERS

*Baker Mfg. Co., Springfield, Ill.
*Bay City Dredge Wks., Bay City, Mich.
*Buckeye Trac. Ditcher Co., Findlay, O.
*Byers Machine Co., Ravenna, O.
*Construction Mch. Co., Waterloo, Ia.
*Ehrlichseger Corp., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Link-Belt Co., Chicago.
*Miami Trailer-Scraper Co., Troy, O.
*Orton Crane & Shovel Co., Chicago.
*Speeder Mch. Corp., Cedar Rapids, Ia.
*Waterman Corp., Detroit.
Austin Mach. Corp., Muskegon, Mich.
Erted Mch. Co., Portland, Ore.
Lennan Loader Mfg. Co., Des Moines
Parsons Co., Newton, Ia.
Weller Mfg. Co., Chicago.

BAR BENDERS AND CUTTERS

*Koehring Co., Milwaukee, Wis.
*Bansome Conc. Mch. Co., Danellen, N.J.
Buffalo Forge Co., Buffalo, N. Y.
Concrete Steel Co., N. Y.
Electric Welding Co., Pittsburgh.
D. A. Hinman & Co., Sandwich, Ill.
J. L. Gleason & Co., Boston, Mass.
McKenna Co., Cleveland, O.

BAR CHAIRS, REINFORCING

*Trucon Steel Co., Youngstown, O.
Concrete Steel Co., N. Y.
Universal Form Clamp Co., Chicago.

BAR TIES

*Bates Valve Bag Co., Chicago.

BATCH BOXES

*Easton Car & Const'n Co., Easton, Pa.
*Heltsel Stl. Form & Ir. Co., Warren, O.
*Lakewood Eng. Co., Cleveland, O.
*Littleford Bros., Cincinnati.
Easton Car & Const'n Co. of Mo., Kansas City, Mo.
Jas. B. Seaverns Co., Batavia, Ill.
Western Wheeled Scraper Co., Aurora, Ill.

BEARINGS

Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bear. Co., Harrison, N. J.
New Departure Mfg. Co., Bristol, Conn.
S. K. F. Industries, New York.
Timken Roller Bearing Co., Canton, O.

BINS, STORAGE

*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Rd. Mach. Co., Chicago.
*Blaw-Knox Co., Pittsburgh, Pa.
*Easton Car & Const'n Co., Easton, Pa.
*Erie Steel Const. Co., Erie, Pa.
*Gallon Iron Wks. & Mfg. Co., Gallon, O.
*Good Roads Mch. Co., Kennett Sq., Pa.
*Heltsel Stl. Form & Ir. Co., Warren, O.

If you find any errors or omissions in this Where to Purchase list, please send corrections to CONTRACTORS' & ENGINEERS' MONTHLY

Where to Purchase

*Link-Belt Co., Chicago.
 *Ransome Conc. Mch. Co., Danellen, N.J.
 *Russell Grader Mfg. Co., Minneapolis.
 *Universal Ed. Mach. Co., Kingston, N.Y.
 Austin Mfg. Co., Chicago.
 Birmingham Tank Co., Birmingham, Ala.
 Brown Hoisting Mch. Co., Cleveland.
 Butler Bin Co., Waukesha, Wis.
 Fairfield Eng. Co., Marion, O.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
 Jas. B. Seaverns Co., Batavia, Ill.
 Weller Mfg. Co., Chicago.

BLAST HOLE DRILLING MACHINES (See Well Drilling and Blast Hole Machines)

BLASTING POWDER (See Explosives)

BLOCKS AND TACKLE
 *Boston & Lockport Bk. Co., E. Boston, Mass.
 *Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
 *Western Block Co., Lockport, N. Y.
 Upson-Walton Co., Cleveland, O.

BLUE PRINT MACHINES

Paragon Mach. Co., Rochester, N. Y.
 C. F. Pease Co., Chicago.
 Wickes Bros., Saginaw, Mich.

BOILERS

*S. Flory Mfg. Co., Bangor, Pa.
 *Johnston Bros., Inc., Ferrysburg, Mich.
 Chandler & Taylor Co., Indianapolis.
 Chatta. Boiler & Tank Co., Chatta., Tenn.
 R. D. Cole Mfg. Co., Newnan, Ga.
 Erie City Iron Wks. Erie, Pa.
 Hartley Bkr. Wks. Montgomery, Ala.
 Heine Boiler Co., St. Louis, Mo.
 E. Keeler Co., Williamsport, Pa.
 Ladd Water Tube Bkr. Co., Pittsburgh, Pa.
 V. Lefell & Co., Springfield, O.
 Lord & Burnham Co., Irvington, N. Y.
 Murray Iron Wks. Co., Burlington, Ia.
 Nagle Eng. & Bkr. Wks. Erie, Pa.
 New Bern Iron Wks. & Snp. Co., New Bern, N. C.
 Petroleum Iron Wks. Co., Sharon, Pa.
 J. S. Schofield's Sons Co., Macon, Ga.
 Stanwood Corp., Cincinnati, O.
 Superior Body Corp., Marion, Ind.
 Traylor Eng. & Mfg. Co., Allentown, Pa.
 Valk & Murdock Co., Charleston, S. C.
 Vogt Mch. Co., Inc., Louisville, Ky.
 Walsh & Weidner Bkr. Co., Chattanooga, Tenn.

BRACES, TRENCH

Jas. H. Channon Mfg. Co., Chicago.
 Duff Mfg. Co., Pittsburgh, Pa.
 Kalamazoo Fdry. & Mach. Co., Kalamazoo, Mich.
 Waldo Bros. & Bond Co., Boston.

BRANDING TOOLS

*Everhot Mfg. Co., Maywood, Ill.

BRASS GOODS

*Union Water Meter Co., Worcester, Mass.
 Glauber Brass, Mfg. Co., Cleveland, O.
 Haydenville Co., Haydenville, Mass.
 Hays Mfg. Co., Erie, Pa.
 Mueller Company, Decatur, Ill.
 United-Obendorf Corp., Cleveland, O.

BREAKERS, CONCRETE

*Ruckeye Trac. Ditcher Co., Findlay, O.
 *Hardsoc Wonder Drill Co., Ottumwa, Ia.
 Chicago Pneumatic Tool Co., N. Y.
 Cleveland Rock Drill Co., Cleveland, O.
 Ingersoll-Rand Co., N. Y.

BRICK, PAVING (See Paving Brick)

BRIDGES AND BUILDINGS, STEEL

*Blaw-Knox Co., Pittsburgh, Pa.
 *Russell Grader Mfg. Co., Minneapolis.

*Frederick Snare Corporation, N. Y.
 American Bridge Co., N. Y.
 Bellefontaine Br. & Sdl. Co., Bellefontaine, O.
 Belmont Iron Wks., Phila.
 Berlin Constr. Co., Berlin, Conn.
 Bethlehem Steel Co., Bethlehem, Pa.
 Boston Bridge Wks. Boston.
 Central States Br. Co., Indianapolis, Ind.
 Champion Bridge Co., Wilmington, O.
 Chesapeake Ir. Wks., Baltimore, Md.
 Chicago Br. & I. Wks., Chicago.
 Clinton Bridge Wks., Clinton, Ia.
 Eastern Bridge & Struc. Co., Worcester, Mass.
 Flour City Orn. Iron Co., Minneapolis.
 Fort Pitt Br. Wks., Pittsburgh, Pa.
 Ingalls Ir. Wks. Co., Birmingham, Ala.
 Inter. Sdl. & Ir. Co., Evansville, Ind.
 Louisville Br. & Ir. Co., Louisville, Ky.
 McClintic Marshall Co., Pittsburgh, Pa.
 Milwaukee Br. Co., Milwaukee, Wis.
 Minn. Sdl. & Mch. Co., Minneapolis.
 Missouri Vy. Br. & Ir. Co., Leavenworth, Kan.
 Morava Constr. Co., Chicago.
 Mt. Vernon Br. Co., Mt. Vernon, O.
 Penn. Bridge Co., Beaver Falls, Pa.
 Pittsburgh-Des Moines Sdl. Co., Pittsburgh, Pa.
 Richmond Struc. Sdl. Co., Richmond, Va.
 Riverside Br. Co., Martins Ferry, O.
 Virginia Br. & Ir. Co., Roanoke, Va.
 Wise Br. & Ir. Co., No. Milwaukee, Wis.

BRONZE TABLETS

Flour City Orn. Ir. Co., Minneapolis.
 Imperial Brass Mfg. Co., Chicago.
 J. L. Mott Iron Wks., N. Y.

BROOMS (See Street Sweeping Brooms)

BUCKETS, AUTOMATIC DUMPING

*Lakewood Eng. Co., Cleveland, O.
 *Union Iron Wks., Inc., Hoboken, N. J.
 G. L. Stuebner Ir. Wks., Inc., Long Island City, N. Y.

BUCKETS, CLAM SHELL

*Blaw-Knox Co., Pittsburgh, Pa.
 *Erie Steel Const'n. Co., Erie, Pa.
 *Geo. Haiss Mfg. Co., N. Y.
 *J. F. Kiesler Co., Chicago.
 *Lakewood Eng. Co., Cleveland, O.
 *Link-Belt Co., Chicago.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Orton Crane & Shovel Co., Chicago.
 Brown Hoisting Mach. Co., Cleveland, O.
 Browning Crane Co., Cleveland, O.
 F. A. Coleman Co., Cleveland, O.
 Hayward Co., N. Y.
 Industrial Wks., Bay City, Mich.
 McMyler Interstate Co., Cleveland, O.
 Owen Bucket Co., Cleveland, O.
 G. H. Williams Co., Erie, Pa.

BUCKETS, CONCRETE

*Insley Mfg. Co., Indianapolis, Ind.
 *Lakewood Eng. Co., Cleveland, O.
 *Ransome Conc. Mch. Co., Dunellen, N. J.
 *Union Iron Wks., Inc., Hoboken, N. J.
 Koppel Ind. Car & Equip. Co., Koppel Pa.
 G. L. Stuebner Ir. Wks., Inc., Long Island City, N. Y.

BUCKETS, DRAGLINE

*Amer. Mfg. & Eng. Co., Kalamazoo, Mich.
 *Dobbie Fdry. & Mch. Co., Niagara Falls, N. Y.
 *Gallion Ir. Wks. & Mfg. Co., Gallion, O.
 *Link-Belt Co., Chicago.
 *Russell Grader Mfg. Co., Minneapolis.
 *Sauerma Bros., Chicago.
 Page Eng. Co., Chicago.
 Pioneer Bucket Co., Indianapolis, Ind.
 Schofield-Burkett Const. Co., Macon, Ga.

BUCKETS, DREDGING AND EXCAVATING

*Blaw-Knox Co., Pittsburgh, Pa.
 *Geo. Haiss Mfg. Co., N. Y.
 *J. F. Kiesler Co., Chicago.
 *Lakewood Eng. Co., Cleveland, O.
 *Link-Belt Co., Chicago.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Orton Crane & Shovel Co., Chicago.
 Brown Hoisting Mach. Co., Cleveland, O.
 Browning Crane Co., Cleveland, O.
 Hayward Co., N. Y.
 Owen Bucket Co., Cleveland, O.
 G. H. Williams Co., Erie, Pa.

BUCKETS, ORANGE PEEL

*J. F. Kiesler Co., Chicago.
 *Link-Belt Co., Chicago.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Orton Crane & Shovel Co., Chicago.
 Hayward Co., N. Y.
 Industrial Wks., Bay City, Mich.
 McMyler Interstate Co., Cleveland, O.

BUILDING, STEEL (See Bridges)

BUNKS AND COTS

Fl. Pitt Bedding Co., Pittsburgh, Pa.
 Haggard & Marcusson Co., Chicago.
 Southern Rome Co., Baltimore, Md.

CABLES (See Wire and Cable)

CABLEWAY, DRAGLINE

*Link-Belt Co., Chicago.
 *Mead-Morrison Mfg. Co., E. Boston, Mass.
 *Russell Grader Mfg. Co., Minneapolis.
 *Sauerma Bros., Chicago.
 *Street Bros. Mach. Wks., Chattanooga.
 Schofield-Burkett Const. Co., Macon, Ga.

CABS FOR MOTOR TRUCKS

Highland Body Mfg. Co., Cincinnati, O.
 Weatherproof Body Corp., Corunna, Mich.

CAISSONS

American Bridge Co., N. Y.
 Birmingham Tank Co., Birmingham, Ala.
 Foundation Co., N. Y.
 Bethlehem Steel Co., Bethlehem, Pa.
 O'Rourke Eng. Constr. Co., N. Y.
 Petroleum Ir. Wks. Co., Sharon, Pa.

CALCIUM CHLORIDE FOR ROADS

*Dow Chemical Co., Midland, Mich.
 *Solvay Sales Corp., New York.
 Carbondale Calcium Co., Carbondale, Pa.

CANS FOR GARBAGE AND REFUSE

American Can Co., N. Y.
 Butler Mfg. Co., Minneapolis.
 Economy Baler Co., Ann Arbor, Mich.
 Rochester Can Co., Rochester, N. Y.
 Solar-Sturges Mfg. Co., Chicago.
 Steel Basket Co., Cedar Rapids, Ia.

CAR UNLOADERS (See Loaders)

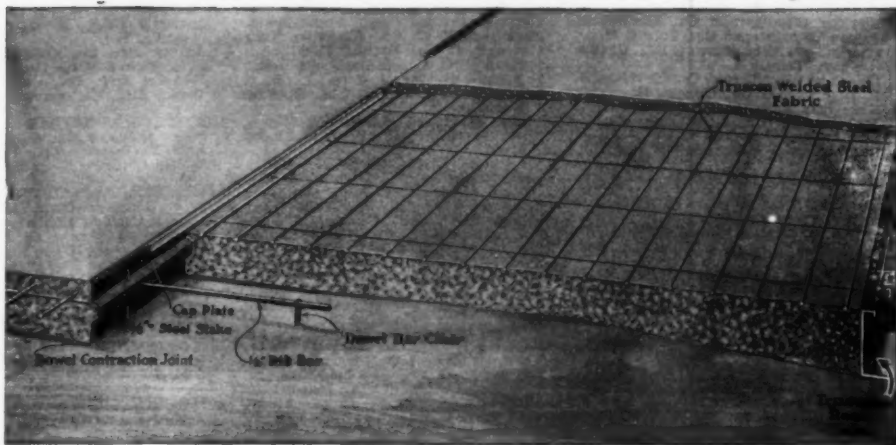
CARS, INDUSTRIAL V. DUMPING

*Easton Car & Const. Co., Easton, Pa.
 *Insley Mfg. Co., Indianapolis, Ind.
 *Lakewood Eng. Co., Cleveland, O.
 Atlas Car & Mfg. Co., Cleveland, O.
 Austin Mach. Corp., Muskegon, Mich.
 Chase Fdry. & Mfg. Co., Columbus, O.
 G. L. Stuebner Ir. Wks., Inc., Long Island City, N. Y.
 C. W. Hunt Co., W. New Brighton, N.Y.
 Koppel Ind. Car & Equip. Co., Koppel Pa.
 United Ir. Wks. Inc., Kans. City, Mo.
 Weller Mfg. Co., Chicago.
 Whiting Corp., Harvey, Ill.

CARTS, CONCRETE

*Akron Barrow Co., Cleveland, O.
 *Easton Car & Const. Co., Easton, Pa.
 *Insley Mfg. Co., Indianapolis, Ind.
 *Lakewood Eng. Co., Cleveland, O.
 *Tuttleford Bros., Cincinnati, O.
 *Ransome Conc. Mch. Co., Dunellen, N.J.
 *T. L. Smith Co., Milwaukee.

* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*



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RIB BARS: for Reinforcing
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 YOUNGSTOWN, OHIO**

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EXHIBIT

January 10th to the 14th
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 Road Show of the American
 Road Builders Association.

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Where to Purchase

*Sterling Wheelbarrow Co., Milwaukee.
 *Toledo Wheelbarrow Co., Toledo, O.
 Chattanooga Wheelbarrow Co., Chattanooga, Tenn.
 Cleveland Wheelbarrow Co., Cleveland, O.
 E. D. Etnyre & Co., Oregon, Ill.
 Gray Iron Fdry. Co., Reading, Pa.
 Jackson Mfg. Co., Harrisburg, Pa.
 Lansing Co., Lansing, Mich.
 Lee Trailer & Body Co., Chicago.

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, STREET AND SEWER

*Central Fdry. Co., N. Y.
 *Gallon Ir. Wks. & Mfg. Co., Gallen, O.
 *U. S. Cast Ir. Pipe & Frgy. Co., Burlington, N. J.
 Burch Plow Wks. Co., Crestline, O.
 Canton Fdry. & Mach. Co., Canton, O.
 Casey-Hedges Co., Chattanooga, Tenn.
 J. B. Clow & Sons, Chicago.
 W. E. Dee Co., Chicago.
 Elkhart Fdry. & Mach. Co., Elkhart, Ind.
 Gilbert Mfg. Co., Aberdeen, S. Dak.
 Klauer Mfg. Co., Dubuque, Ia.
 Madison Fdry. Co., Cleveland, O.
 Pechstein Iron Works, Keokuk, Ia.
 Sessions Foundry Co., Bristol, Conn.
 South Bend Fdry. Co., So. Bend, Ind.

CATCH BASINS (See Castings, Street)

CATCH BASIN CLEANING OUTFITS

*Mack Trucks, Inc., N. Y.
 Atlas Corp., N. Y.
 Elgin Sales Corp., N. Y.
 Movakan Co., Indianapolis, Ind.

CAULKING MACHINERY AND TOOLS

Cleveland Rock Drill Co., Cleveland, O.
 Helwig Mfg. Co., St. Paul, Minn.
 Ingersoll-Rand Co., N. Y.
 Mueller Company, Decatur, Ill.

CEILINGS, METAL

Berger Mfg. Co., Canton, O.
 Canton Art Metal Co., Canton, O.
 Globe Iron Roofing & Cor. Co., Cincinnati, O.
 Newport Rolling Mill Co., Newport, Ky.
 Klauer Mfg. Co., Dubuque, Ia.
 Geo. L. Mesker & Co., Evansville, Ind.
 Milwaukee Corr. Co., Milwaukee.
 Wheeling Corr. Co., Wheeling, W. Va.

CEMENT (P. C. stands for Portland Cement)

*Pennsylvania-Dixie Cement Corp., N. Y.
 (Brands: Pennsylvania, Dexter, Penn-Allen, Royal & Clinchfield P. C.)
 Acme Cement Corp., Catskill, N. Y.
 Aetna P. C. Co., Detroit, Mich.
 Alabama P. C. Co., Birmingham, Ala.
 Allentown P. C. Co., Catsanagna, Pa.
 Alpha F. C. Co., Easton, Pa.
 Ash Grove Lime and P. C. Co., Kansas City, Mo.
 Atlas P. C. Co., N. Y.
 Beaver P. C. Co., Portland, Ore.
 Bessemer Limestone & C. Co., Youngstown, O.
 British Col. Cement Co., Victoria, B. C.
 Canada Cement Co., Ltd., Montreal, Canada.
 Colorado P. C. Co., Denver, Colo.
 Consolidated Cement Corp., Chicago.
 Cowell P. C. Co., Cowell, Cal.
 Crescent P. C. Co., Wampum, Pa.
 Dewey P. C. Co., Kansas City, Mo.
 Diamond P. C. Co., Cleveland, O.
 Edison P. C. Co., N. Y.
 Georgia Cement & Stone Co., Birmingham, Ala.
 Giant P. C. Co., Philadelphia, Pa.
 Glens Falls P. C. Co., Glens Falls, N.Y.
 Golden State P. C. Co., Los Angeles, Cal.
 Great West'n. P. C. Co., Kans. C. Mo.
 Hawkeye P. C. Co., Des Moines, Ia.

Hercules Cement Corp., Philadelphia.
 Hermitage P. C. Co., Nashville, Tenn.
 Huron P. C. Co., Detroit, Mich.
 Indiana P. C. Co., Indianapolis, Ind.
 International Cement Corp., N. Y.
 International P. C. Co., Ltd., Spokane, Wash.

Kansas P. C. Co., Kansas City, Mo.
 Knickerbocker P. C. Co., Inc., Albany, N. Y.
 Kosmos P. C. Co., Louisville, Ky.
 La Tolteca Compania de Cemento Portland, Mexico City, Mex.
 Lawrence P. C. Co., New York.
 Lehigh P. C. Co., Allentown, Pa.
 Louisville Cement Co., Louisville, Ky.
 Manitowoc P. C. Co., Manitowoc, Wis.
 Marlboro Cement Co., Edmonton, Can.
 Marquette Cement Mfg. Co., Chicago.
 Missouri P. C. Co., St. Louis, Mo.
 Monarch Cement Co., Humboldt, Kans.
 Monolith P. C. Co., Los Angeles, Cal.
 National Cement Co., Birmingham, Ala.
 Nazareth Cement Co., Nazareth, Pa.
 Nebraska Cement Co., Denver, Colo.
 Newago P. C. Co., Newago, Mich.
 New Egyptian P. C. Co., Detroit.
 North Amer. Cement Corp., Albany, N. Y.
 Northwestern States P. C. Co., Mason City, Ia.

Oklahoma P. C. Co., Denver.
 Olympic P. C. Co., Ltd., Seattle.
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 Petoskey P. C. Co., Petoskey, Mich.
 Phoenix P. C. Co., Philadelphia.
 Pgh. Plate Glass Co., Zanesville, O.
 P. C. Co. of Utah, Salt Lake City.
 Pyramid P. C. Co., Des Moines.
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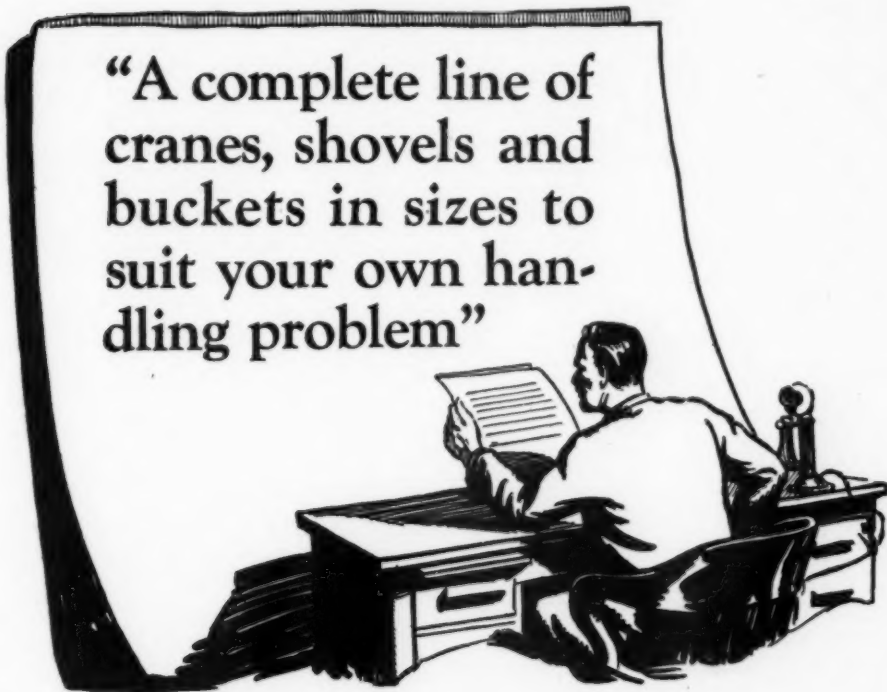
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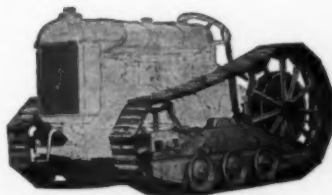
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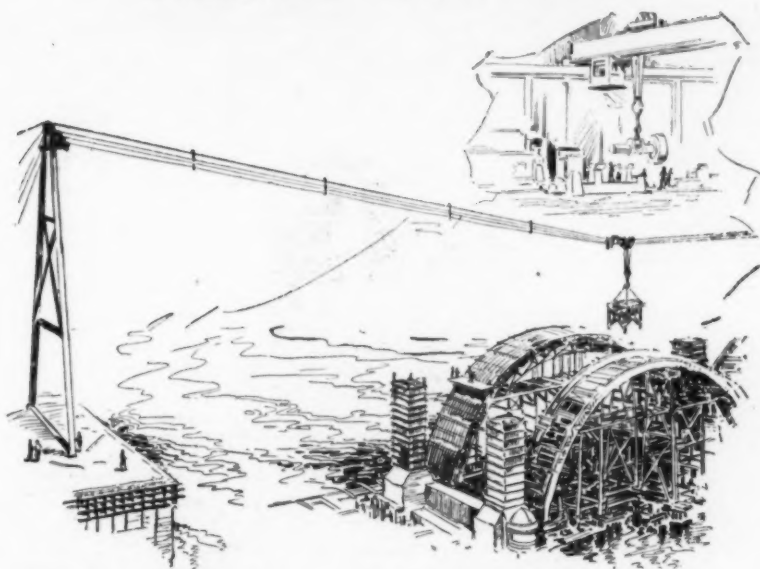
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- POWDER** (See Explosives)
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*Servel Mfg. Co., Evansville, Ind.
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Sanderson-Cyclone Drill Co., Orrville, O.
Wisconsin Motor Co., Milwaukee
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John Waldron Corp., New Brunswick, N. J.
- PUMP JACKS**
*John Lauson Mfg. Co., New Holstein, Wis.
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*American Steam Pump Co., Battle Creek, Mich.
*Sullivan Mach Co., Chicago
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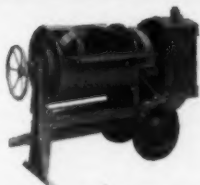
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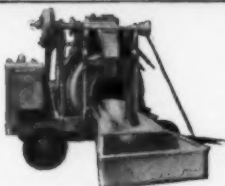


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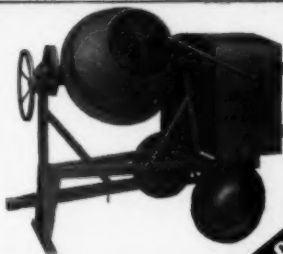
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 Allis-Chalmers Mfg. Co., Milwaukee.
 Austin Mfg. Co., Chicago.
 Brown Hatz. Machy Co., Cleveland, O.
 C. O. Bartlett & Snow Co., Cleveland, O.
 J. I. Case Threshing Mach Co., Racine, Wis.

Deister Concentrator Co., Ft. Wayne, Ind.
 Gifford-Wood Co., Hudson, N. Y.
 Hendrick Mfg. Co., Carbondale, Pa.
 Jeffrey Mfg. Co., Columbus, O.
 Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
 Morrow Mfg. Co., Wellston, O.
 Newwayo Eng. Co., Newwayo, Mich.
 New Jersey Wire Cloth Co., Trenton, N. J.

Robins Concr. Belt Co., N. Y.
 H. B. Sackett Screen & Chute Co., Chicago.
 Universal Rd. Mach. Co., Kingston, N.Y.
 Webster Mfg. Co., Chicago.
 Weller Mfg. Co., Chicago.
 Wickwire Spencer Steel Co., N. Y.

SCREENS, SEWAGE

*Link-Belt Co., Philadelphia.
 Dorr Co., New York.
 Green Bay Fdry. & Mach. Wks., Green Bay, Wis.
 Sanitation Corp'n., N. Y.
 Simplex Ejector Co., Chicago.

SEWAGE DISPOSAL APPARATUS

*Link-Belt Co., Chicago.
 *Pacific Flash Tank Co., Chicago & N. Y.
 Dorr Co., N. Y.
 Sanitation Corp'n., N. Y.
 Simplex Ejector Co., Chicago.

SEWAGE PUMPS (See Pumps)

SEWAGE EJECTORS

*Pacific Flash Tank Co., Chicago & N. Y.
 Sanitation Corp'n., N. Y.
 Simplex Ejector Co., Chicago.
 Yeomans Bros. Co., Chicago.

SEWER BLOCKS, SEGMENT

American Vit. Products Co., Akron, O.
 Cannelton Sewer Pipe Co., Cannelton, Ind.
 Denver Sewer Pipe & Clay Co., Denver, Col.
 W. S. Dickey Clay Mfg. Co., Kansas City, Mo.
 Evens & Howard Fire Brick Co., St. Louis, Mo.
 Laclede Christy Clay Prod. Co., St. Louis, Mo.
 Macomb Sewer Pipe Wks., Macomb, Ill.
 Pacific Clay Prod. Co., L. Angeles, Cal.
 Red Wing Sewer Pipe Co., Red Wing, Minn.
 Robinson Clay Prod. Co., Akron, O.
 Standard Fire Brick & Sewer Pipe Co., Pueblo, Col.

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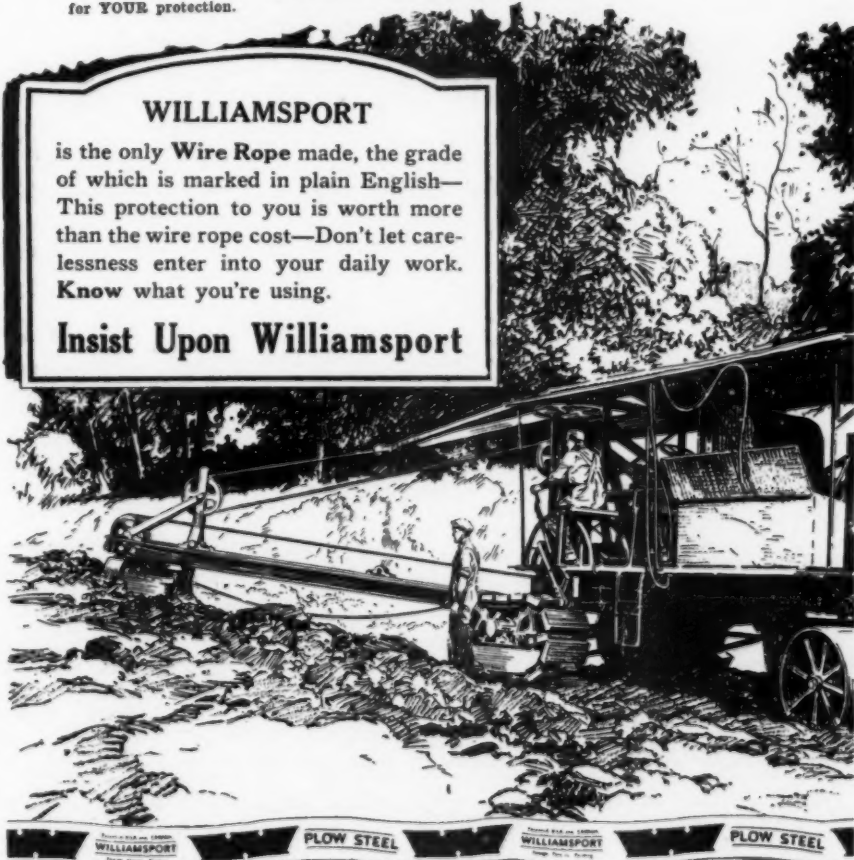
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Turbine Sewer Mach. Co., Milwaukee.

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Blackmer & Root Pipe Co., St. Louis.
Wm. E. Dee Co., Chicago.
Denver Sewer Pipe & Clay Co., Denver, Col.
W. S. Dickey Clay Mfg. Co., K. City, Mo.
Logan Clay Prod. Co., Logan, O.
Ohio Vit. Pipe Co., Uhrichsville, O.
Robinson Clay Prod. Co., Akron, O.

SEWER PIPE FORMS

*Heltzel St. Form & Ir. Co., Warren, O.
Quinn Wire & Iron Wks., Boone, Ia.
Raber & Lang Mfg. Co., Kendallville, Ind.

SEWER PIPE JOINT COMPOUNDS

*Pacific Flush Tank Co., Chicago & N. Y.
O. K. Sales Agency, Macungie, Pa.
Ruberoid Co., N. Y.
Servicised Prod. Corp., Chicago

SEWER RODS

F. Bissell Co., Toledo, O.
Champion Corp., Hammond, Ind.
P. J. Healy, Jersey City, N. J.
Luck Sewer Equip. Co., Chicago.
Turbine Sewer Mach. Co., Milwaukee.

SHINGLES, METAL

Aluminum Co. of Am., Pittsburgh, Pa.
Berger Mfg. Co., Canton, O.
Canton Art Metal Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
Klauser Mfg. Co., Dubuque, Ia.
Milwaukee Corrugating Co., Milwaukee.
Nat'l Sheet Metal Roofing Co., Jersey City, N. J.
Newport Rolling Mill Co., Newport, Ky.
Penn Metal Co., Boston, O.
Tiffin Art Metal Co., Tiffin, O.
Wheeling Metal Mfg. Co., Wheeling, W. Va.

SHORES

Dayton Sure Grip & Shore Co., Dayton, O.
M. & M. Wire Clamp Co., Minneapolis.
The O. D. G. Co., Owensboro, Ky.
H. W. Roos Co., Cincinnati, O.
Roos-Meyer-Recht Co., Cincinnati, O.
Symons Clamp & Mfg. Co., Chicago.
Universal Form Clamp Co., Chicago.

SHOVELS, ELECTRIC

*Bay City Dredge Wks., Bay City, Mich.
*Byers Mach. Co., Ravenna, O.
*Koehring Co., Milwaukee, Wis.
*Link-Belt Co., Chicago.
*Speeder Machy. Corp., Cedar Rapids, Ia.
*Thew Shovel Co., Lorain, O.
Bucyrus Co., So. Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

SHOVELS, GASOLINE

*Bay City Dredge Wks., Bay City, Mich.
*Byers Mach. Co., Ravenna, O.
*Harnischfeger Corp., Milwaukee, Wis.
*Koehring Co., Milwaukee, Wis.
*Link-Belt Co., Chicago.
*Orton Crane & Shovel Co., Chicago.
*Speeder Machy. Corp., Cedar Rapids, Ia.
*Thew Shovel Co., Lorain, O.
*Universal Power Shovel Co., Detroit.
Amer. Steel Dredge Co., Ft. Wayne, Ind.
Austin Mach. Corp., Muskegon, Mich.
Brown Htg. Machy. Co., Cleveland, O.
Bucyrus Co., So. Milwaukee, Wis.
Erie Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Osgood Co., Marion, O.

SHOVELS, HAND

America Mfg. Co., Chattanooga, Tenn.
Ames Shovel & Tool Co., Boston.
Beall Bros. Co., Alton, Ill.

Conneaut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Jackson Shovel Co., Montpelier, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Russell Shovel Co., Alliquippa, Pa.
Stevens-Webb Co., Inc., Altoona, Pa.
Union Furnace Mfg. Co., Altoona, Pa.
Wood Shovel & Tool Co., Piqua, O.
Wyoming Shovel Wks., Wyoming, Pa.

SHOVELS, STEAM

*Erie Steam Shovel Co., Erie, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
*Orton Crane & Shovel Co., Chicago.
*Thew Shovel Co., Lorain, O.
Austin Mach. Corp., Muskegon, Mich.
Bellwood Stm. Shovel Co., Bellwood, Pa.
Bucyrus Co., So. Milwaukee, Wis.
Industrial Wks., Bay City, Mich.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Russell & Co., Massillon, O.

SIDEWALK AND ROAD FORMS (See Forms, Concrete)

SIGNS, STREET AND ROAD

Alumoyd Sign & Signal Co., Chicago.
Auto Sign Display Co. of Mo., St. Louis, Mo.
Baltimore Enam. & Nov. Co., Baltimore.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Evernu-Century Sign Co., Boston.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Lyle-Signs, Minneapolis, Minn.
Municipal Street Sign Co., N. Y.
Rochester St. Signal Co., Rochester, N.Y.
Standard Mfg. Co., Cedar Falls, Ia.
Union Iron Prod. Co., E. Chicago, Ind.
Western Stamping & Mfg. Co., St. Paul

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Acme Traffic Signal Co., Los Angeles.
Alumoyd Sign & Signal Co., Chicago.
Auto Sign Display Co. of Mo., St. Louis, Mo.
Automatic Signal & Sign Co., Canton, O.
Amer. Gas Accumulator Co., Elizabeth, N. J.
Crouse-Hinds Co., Syracuse, N. Y.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Esco Mfg. Co., Peoria, Ill.
Evernu-Century Sign Co., Boston.
Grissold Safety Signal Co., Minneapolis.
Horn Signal Mfg. Corp., Newark, N. J.
Line Material Co., So. Milwaukee, Wis.
Little Giant Co., Mankato, Minn.
Lyle-Signs, Minneapolis, Minn.
Ohio Traffic Devices Co., Columbus, O.
Rochester St. Signal Co., Rochester, N.Y.
Tokheim Oil Tank & Pump Co., Ft. Wayne, Ind.
Union Iron Prod. Co., E. Chicago, Ind.
Universal Traffic Control Co., Oklahoma City, Okla.

SLEEVES, TAPPING AND VALVE

Mueller Company, Decatur, Ill.
Rensselaer Valve Co., Troy, N. Y.
A. P. Smith Mfg. Co., East Orange, N.J.

SLUICE GATES (See Gates, Sluice)

SMOKE STACKS (See Stacks, Steel)

SNOW CLEANING MACHINERY

*Austin-Western Rd. Mch. Co., Chicago.
*Baker Mfg. Co., Springfield, Ill.
*Barber-Greene Co., Aurora, Ill.
*Byers Mach. Co., Ravenna, O.
*Caterpillar Tractor Co., San Leandro, Calif. and Peoria, Ill.
*Cleveland Tractor Co., Cleveland, O.
*Gallon Iron Wks. & Mfg. Co., Gallon, O.
*Good Eds. Mach. Co., Kennett Sq., Pa.
*La Plant-Chaste Mfg. Co., Cedar Rapids, Ia.
*Mack Trucks, Inc., N. Y.
*Mead-Morrison Mfg. Co., E. Boston.
*Russell Grader Mfg. Co., Minneapolis.

C. D. Edwards Mfg. Co., Albert Lea, Minn.

Hilway Service Corp., Wausau, Wis.
Killefer Mfg. Co., Los Angeles, Cal.
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Monarch Tractors Corp., Springfield, Ill.
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Rotary Snow Plow Co., Minneapolis.
Shaw-Enochs Tractor Co., Minneapolis.
W. M. Toy Co., Sidney, O.
Union-Iron Wks., Inc., Bangor, Me.
Walsha Holyoke St. Blr. Wks., Holyoke, Mass.

SNOW FENCING (See Fencing)

SPADES (See Shovels)

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*Littleford Bros., Cincinnati.
Kinney Mfg. Co., Boston.

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Bean Spray Pump Co., Lansing, Mich.
Field Force Pump Co., Elmira, N. Y.
Fitzhenry-Gupitill Co., E. Cambridge, Mass.

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*Gallon Ir. Wks. & Mfg. Co., Gallon, O.
Burch Plow Wks. Co., Crestline, O.
Shaw-Enochs Tractor Co., Minneapolis.

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*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Inc., Philadelphia.
*Heil Co., Milwaukee, Wis.
*Jos. Honhorst Co., Cincinnati, O.
*Littleford Bros., Cincinnati, O.
*N. Y. Central Iron Wks. Co., Inc., Hagerstown, Md.
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Graver Corp., Chicago.
Petroleum Iron Wks. Co., Sharon, Pa.
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Walsh & Weidner Boiler Co., Chattanooga, Tenn.

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Chatta. Blr. & Tank Co., Chatta., Tenn.
Chicago Bridge & Iron Wks., Chicago.
Lancaster Iron Wks., Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco.
Petroleum Ir. Wks. Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Wks., Inc., K. City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS (See Shovels, Steam)

STEAM TURBINES (See Turbines)

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*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Philadelphia.
*Heil Co., Milwaukee, Wis.
*Heltzel St. Form & Ir. Co., Warren, O.
*Jos. Honhorst Co., Cincinnati, O.
*Littleford Bros., Cincinnati, O.
*Union Iron Wks., Inc., Hoboken, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Chatta. Boiler & Tank Co., Chatta., Tenn.
Chicago Bridge & Iron Wks., Chicago.
Graver Corp., E. Chicago, Ind.
Hendrick Mfg. Co., Carbondale, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
N. Y. Central Iron Wks. Co., Inc., Hagerstown, Md.
Penna. Bridge Co., Beaver Falls, Pa.
Petroleum Iron Wks. Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Ritter-Conley Co., Pittsburgh, Pa.
W. B. Scalfie & Sons, Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
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Detroit Stoker Co., Detroit.
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*Austin-Western Rd. Mch. Co., Chicago.
*Gallon Ir. Wks. & Mfg. Co., Gallon, O.
*Hell Co., Milwaukee, Wis.
*Kinney Mfg. Co., Boston.
*Mack Trucks, Inc., N. Y.
Autocar Co., Ardmore, Pa.
E. D. Etnyre & Co., Oregon, Ill.
Federal Motor Truck Co., Detroit.
Chas. Hvas & Co., N. Y.
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White Co., Cleveland, O.
Yellow Truck & Coach Mfg. Co., Chicago

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King Mfg. Co., Chicago.
Union Metal Mfg. Co., Canton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

STREET SIGNS (See Signs, Street)

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*Austin-Western Rd. Mch. Co., Chicago.
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*Kinney Mfg. Co., Boston.
Butler Mfg. Co., Cleveland, O.
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Lang Broom Co., Pittsburgh, Pa.
Jos. Lay Co., Ridgeville, Ind.
Milwaukee Brush Mfg. Co., Milwaukee.
Osborn Mfg. Co., Cleveland, O.

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Kendallville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, O.

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*La Plant-Chaste Mfg. Co., Cedar Rapids, Ia.
Ersted Machy. Mfg. Co., Portland, Ore.
H. L. Bennett & Co., Westerville, O.
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Birmingham Tank Co., Birmingham, Ala.
Chicago Bridge & Iron Wks., Chicago.
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Dover Boiler Wks., N. Y.
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Eagle Tank Co., Chicago.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
Natl. Tank & Pipe Co., San Francisco.
Pacific Tank & Pipe Co., San Francisco.
Redwood Mfrs. Co., San Francisco.
A. T. Stearns Lumber Co., Boston.
U. S. Wind Eng. & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago.

TANK WAGONS

*Acme Ed. Mach. Co., Frankfort, N. Y.
*Gallon Ir. Wks. & Mfg. Co., Gallon, O.
*Hell Co., Milwaukee, Wis.
*Jos. Honhorst Co., Cincinnati, O.
*Mack Trucks, Inc., N. Y.
Butler Mfg. Co., Minneapolis, Minn.
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TAR

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Amer. Tar Prod. Co., Pittsburgh, Pa.

TAR KETTLES (See Kettles)

THAWING OUTFITS

*Acroil Burner Co., Union Hill, N. J.
*Littleford Bros., Cincinnati.
Hauck Mfg. Co., Bklyn., N. Y.

TIE TAMPERS

Electric Tamper & Equip. Co., Chicago.

TIE BOLTS FOR WALL FORMS

*Hawley Tie Bolt Co., Minneapolis.

TIES, STEEL

Carnegie Steel Co., Pittsburgh, Pa.
Int'l. Steel Tie Co., Cleveland, O.
Koppel Ind. Car & Equip. Co., Koppel, Pa.
Sweet's Steel Co., Williamsport, Pa.

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Pyle-Rogers Corp., N. Y.

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Firestone Tire & Rubber Co., Akron, O.
Fisk Tire Co., Chicopee Falls, Mass.
Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Kelly Springfield Tire Co., N. Y.
U. S. Tire Co., N. Y.

TOOL HOUSES, PORTABLE STEEL

*Blaw-Knox Co., Pittsburgh, Pa.
*Littleford Bros., Cincinnati, O.

TORCHES, OIL (HEATING)

*Chausse Oil Burner Co., Elkhart, Ind.
*Littleford Bros., Cincinnati.
*Mead-Morrison Mfg. Co., E. Boston.
*Alex. Milburn Co., Baltimore, Md.
Hauck Mfg. Co., Bklyn., N. Y.

TOWERS (See Standpipe, Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE

*Easton Car & Constn. Co., Easton, Pa.
*Lakewood Eng. Co., Cleveland, O.
Atlas Car & Mfg. Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
C. W. Hunt Co., Inc., W.N. Brighton, N.Y.
Koppel Ind. Car & Equip. Co., Koppel, Pa.
Sweet's Steel Co., Williamsport, Pa.

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*Bates Mfg. Co., Joliet, Ill.
*Caterpillar Tractor Co., San Leandro, Calif.
*Cleveland Tractor Co., Cleveland, O.
*Geo. Hais Mfg. Co., New York.
*Huber Mfg. Co., Marion, O.
*J. T. Tractor Co., Cleveland, O.
*John Lanson Co., New Holstein, Wis.
*Mack Trucks, Inc., N. Y.
*Mead-Morrison Mfg. Co., E. Boston.
*Rogers Bros. Corp., Albion, Pa.
Advance-Rumely Thresher Co., Laporte, Ind.
Allis-Chalmers Mfg. Co., Milwaukee.
Clark Tractor Co., Buchanan, Mich.
Emerson-Brantingham, Rockford, Ill.
Ford Motor Co., Detroit, Mich.
Hart-Parr Co., Charles City, Ia.
Int'l. Harvester Co., Chicago.
Kinnaard & Haines, Minneapolis, Minn.
Lombard Tractor & Truck Corp., N. Y.
Minneapolis Steel & Mach. Co., Minneapolis.
Monarch Tractors Corp., Springfield, Ill.
Shaw-Enoch Tractor Co., Minneapolis.

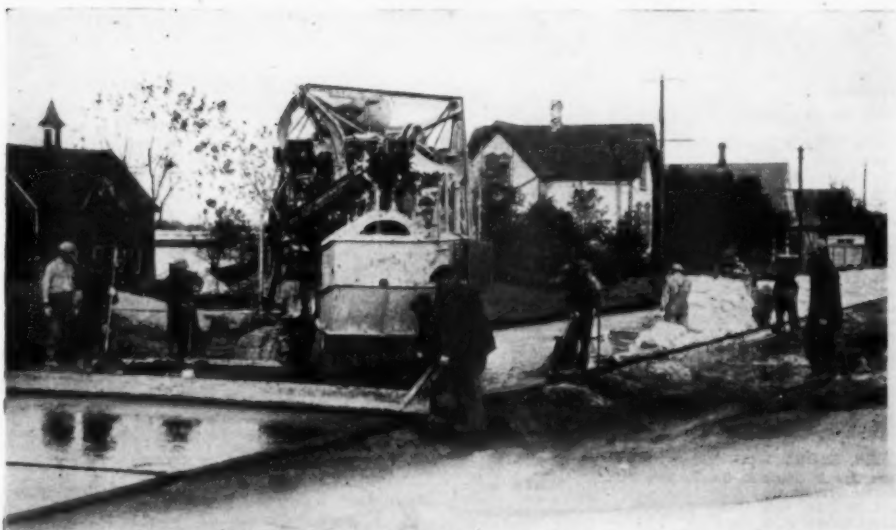
TRAFFIC LINE MARKERS

Continental Prod. Co., Euclid, O.
Line-O-Graph Co., N. Y.
Tenn. Tool Wks. Inc., Knoxville, Tenn.

TRAFFIC PAINT

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Continental Prod. Co., Euclid, O.
Hanline Bros., Baltimore, Md.
Hoosier Paint Wks., Ft. Wayne, Ind.

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Mixer performance — that's what you want **NOW!**

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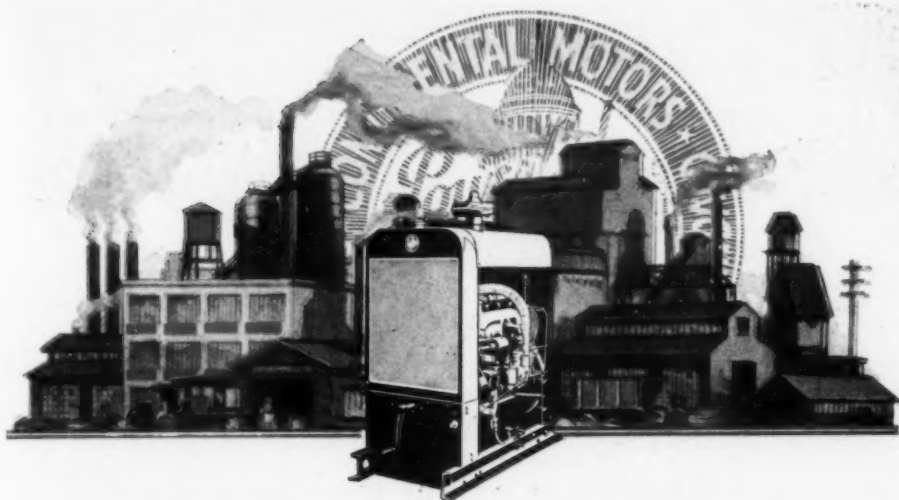
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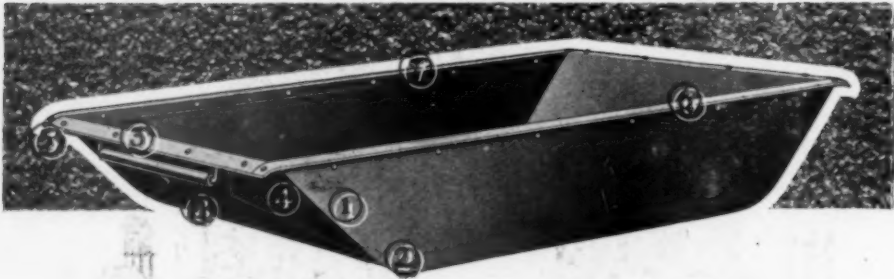
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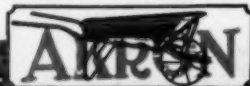
*That's just one of the eight
real advantages. Check
them point by point---*

- 1.** The ends slope to follow the natural path of the hoe—Easier mixing and emptying of the box.
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Made in three standard sizes.

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Wheel Barrows • Salamanders • Concrete Carts • Scrapers • Coal Chutes



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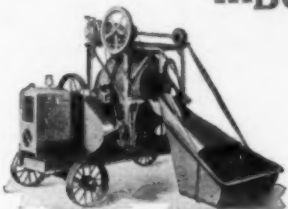
To insure this profit this year means still better success in the future—and it is up to you now to see that all your equipment is right.

Little leaks here and there—delays that hold up work while your pay-roll goes on—these are vital spots to plug up.

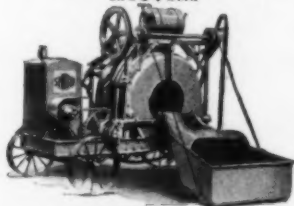
Thousands of contractors have learned the real value of Smith Mixers—the speedy operation means maximum production per hour—the superior design and workmanship reduce the costly delays—keep the whole gang at work which is necessary to insure your profits.

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Our new Catalog 526 is the most complete book on Concrete Mixers in existence.--- Interesting and well illustrated. Be sure to obtain your copy before the present supply is exhausted. Write today.



The Smith 10-S Tilling mixer with power loader and water tank. Two bag batch capacity on 1-2-4 work



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From the quality of Sterling wheelbarrows which have always proven satisfactory, we like the service which goes with your product. We find that we can secure your equipment and repairs quickly within the wide range of office in which we operate.

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Material Handling**• EQUIPMENT**

On Its Fifth Job

B. J. REGNELL, a Chicago contractor, has had an INSLEY MAST HOIST with a boom and counterweight chute since September, 1925. This plant has finished four jobs and is pouring its fifth, and has never yet been in the contractor's yard for a day since it was bought. It has been money-making equipment for B. J. Regnell.

Stop and think of it! One steel mast plant has been on five separate jobs in eighteen months, has been put up and taken down five separate times, has poured thousands of yards of concrete with only one or two men handling chutes, and today it is as good as it was when it was first set up. How many wood towers would have been built to do the same work? How many men would have been required to push the buggies to wheel all that concrete in place? And where would all the money be today that might

have been spent on these towers and wheelers? It would be gone, wasted, lost.

In addition, B. J. Regnell has a three-wheel-barrow MATERIAL ELEVATOR, which has hoisted all the brick, tile and other material on these jobs. Each time this material elevator was used it saved a wooden elevator cage and has more than paid for itself every time it was attached to the mast.

Many advantages attend the use of the Insley Mast Hoist. Its first cost is low; it is easy and economical to erect; it is made of steel and is permanent equipment; it can be used to hoist not only concrete but miscellaneous material; and it can be used with a boom and counterweight chute. Any of the above advantages is justification for buying an Insley Mast Hoist, and all of them together make it a combination that cannot be beaten.

INSLEY MANUFACTURING
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A NEW METHOD OF LICKING A COSTLY PROBLEM

**SEND NOW
FOR
YOUR COPY**

*Our illustrated
folder on this
handy one-ton
Crane is yours on
request.*

The photograph shown on this page provides an excellent illustration of the value of the W&K One-Ton Crane in the Contracting Field.

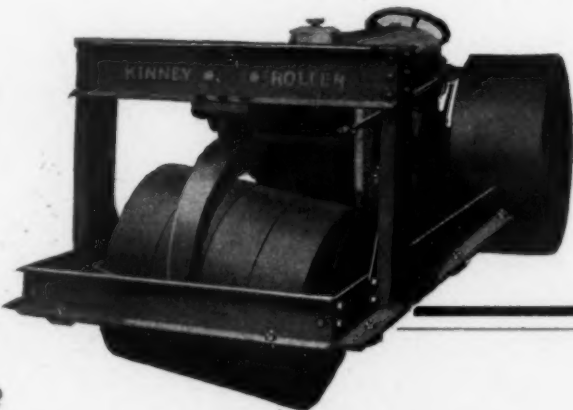
Previous to the installation of this Crane, if a track moving machine was not available it was often necessary to use from eight to fourteen men with bars and jacks on this work,—a very costly operation.

The W&K One-Ton Crane is built in two sizes, with 7- and 12-ft. lifts. The operating costs are very low, and replacement parts easy to get. In addition to the lifting and carrying work that the Crane does, the Fordson is always available for general hauling.



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The

ROADROLLER

**Has quality and cost advantage.
Travels fast, rolls slowly—as needed.
Steers easily as the standard tractor.
Is practically impossible to upset.
Standard rolls cover path 63 inches wide.
Rollers under 6-tons interchange parts.**

The 2-ton ROADROLLER, approximately 4000 lbs., with Fordson body, ready for work, goes anywhere; without Fordson body, shipment weighs 2400 lbs. The Roller frame clamps to the regular Fordson body.

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For distinctive parks, fairways and estates
we have the front SUPERLAWNMOWER
and the (tractor) LAWNROLLER.

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Simply Bolt Halves Together and Remove Temporary Legs

HELTZEL 80- and 105-ton Twin Trailer Bins are dismantled, removed and set up for operation in considerably less time and less cost than other makes of bins one-third the size. Only 40 bolts in assembling and shelf angle on each temporary leg instantly aligns bolt holes of two halves.

Removed from one set-up to another in 4 or 5 hours. Transported through congested traffic at 10 to 20 miles per hour. Built like a skyscraper. Heavy reinforced, riveted construction throughout. Heavy 8-in. x 8-in. steel angle legs. 4-in. x 4-in. steel angle bracing.

All parts reached by permanent steel ladders.

A giant of giants. 11 ft. 3 in. x 18 ft. x 20 ft. high in the 80-ton and 22 ft. high in the 105-ton.

Operation by single hand wheel and by single operator. Operator stationed on **TRILOK** steel grating platform where he can see that all conditions are right for dumping the batches.

New Automatic Weighing Agrabatchers standard modified beam type of scale with two point suspension of load and equaliser. Will fill and weigh even though bin is not level.

Measuring Agrabatchers. A minimum of six batches per minute.

Agrabatcher Adjusting Device supplied only on order. The turn of a single control wheel raises or lowers agrabatchers simultaneously on all four supporting bolts.

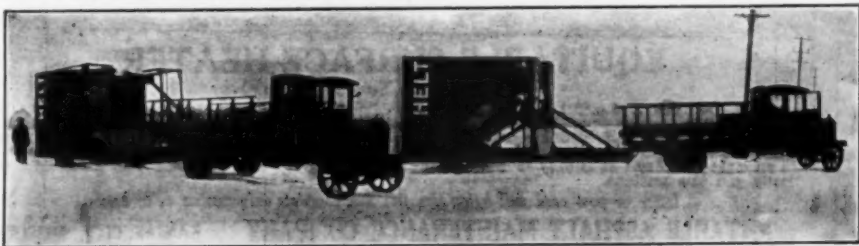
Shipped completely assembled in two halves. Only trailer wheels detached.

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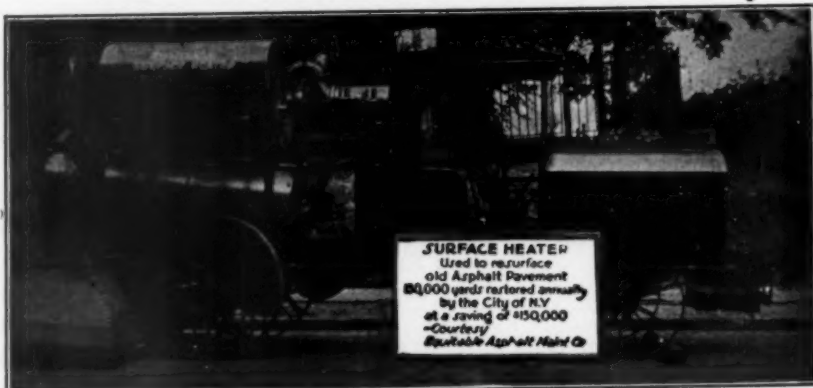
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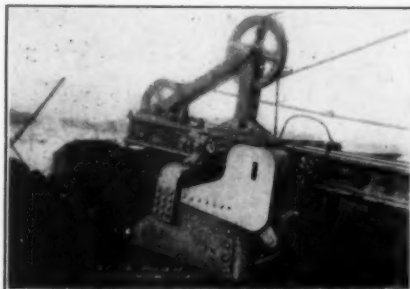
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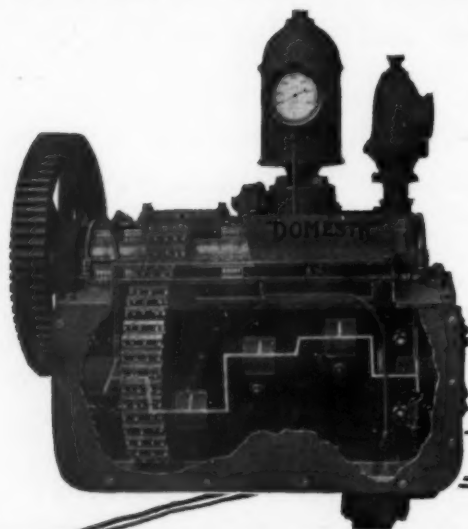
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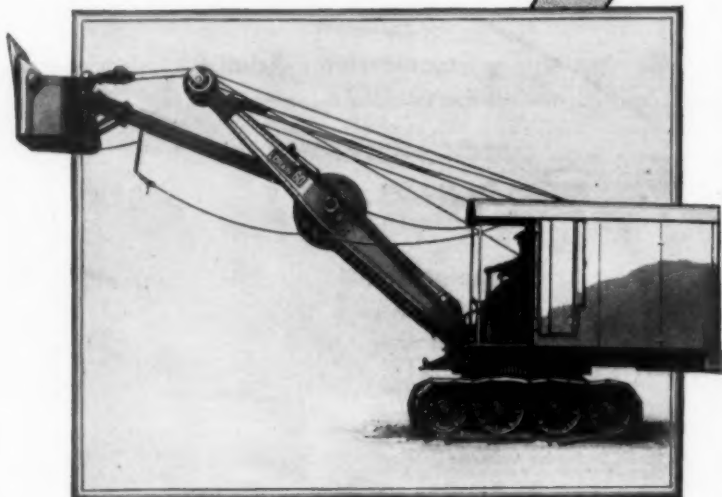
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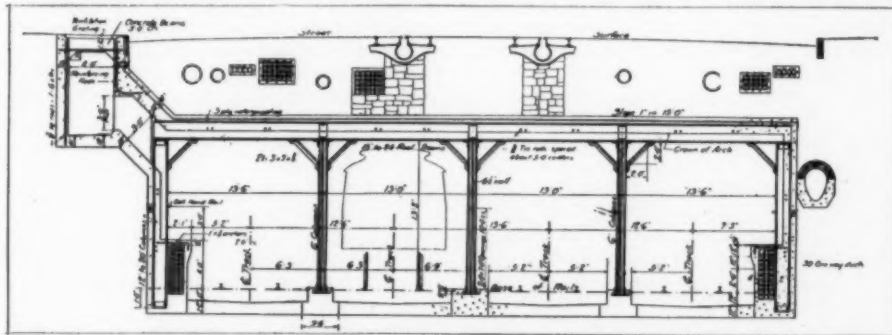
The Handling of Subsurface Structures in Subway Construction

By ROBERT RIDGWAY

Chief Engineer, Board of Transportation, New York City

WHEN William Barclay Parsons designed the first subways built in New York City, twenty-five years ago, he decided after careful consideration to build them, wherever the topographical conditions would permit, as close to the street surface as practicable. This was a wise provision for a number of reasons. Among other advantages, it reduces climbing at stations, avoiding the use of escalators and elevators, thus making for convenience and economy. This general

there, it is necessary to go quite deep, in some cases to the third level below the street, with new structures that have to pass under existing ones. The deep tunnel, however, would not be a simple thing to construct. It would be difficult to excavate a cavern in the rock large enough for a four-track station under the city streets, and more difficult if the material was saturated sand. Then, to handle the rush-hour crowds in stations far below the surface would require the installation and operation of bat-



STANDARD FOUR-TRACK SUBWAY ON ONE LEVEL WITH PROVISION FOR VENTILATION, SHOWING ALSO VARIOUS SUBSURFACE STRUCTURES

plan is still believed to be the preferable one and is being followed to-day. It has, of course, objections which would not apply to deep tunnel construction. During the construction period it requires the tearing up of the streets, interfering with street traffic, it involves much adjustment of the subsurface utilities, and introduces hazards of construction which necessitate expensive safeguards. Perhaps the time is not far away when deep tunnel construction will be used for new subways in Manhattan, because, with the many subways that are now

teries of large elevators at a great expense.

If the building of a subway were merely the digging of a trench, erecting the structure, back-filling, and restoring the street surface, the task would be difficult enough, but added to this is the care of the adjacent buildings, a large percentage of which require expensive underpinning, as well as the maintenance, support and restoration of the hundreds of miles of subsurface utilities, such as water-mains and steam-mains, sewers, telephones and electric light cables. The direct and indirect cost to



COMPLETED
SYSTEM OF SUB-
SURFACE STRUCTURES
OVER THE WILLIAM
STREET SUEWAY
AT THE CORNER OF
WALL STREET,
NEW YORK

the city for the care of these subsurface utilities, exclusive of the underpinning of the buildings, averages probably 15 per cent of the cost of subway construction. As an example of how these costs run up, the estimated expense of restoring the telephone and Edison cables on the half-mile of subway under Eighth Avenue between 111th and 121st Streets, exclusive of the cost of laying the ducts, is about \$285,000. On this stretch there are about twenty miles of telephone cables alone to be redrawn.

The New York subways are generally of the two-track or four-track types. Normally, all tracks are at the same level, but, frequently, where economy of construction will result, the structure is double decked. Under Central Park West, for example, the four-track subway now being constructed is of the double-deck type, the upper tracks being for north-bound traffic and the lower ones for south-bound traffic.

The typical four-track subway railroad which is being built in New York has an overall width of about 60 feet and a height of about 17 feet. There are many variants from this type, determined by local conditions and connections to be made with existing railroads. In general, subways are located as near to the street surface as is practicable, to reduce the amount of excavation. In this matter we are governed by the underground structures which are encountered. As a rule, we endeavor to have 6 feet of cover over the subway roof and follow generally the grade of the street surface. But on account of the presence of existing subways and important underground structures which have to be

crossed, or because the grades of the streets are greater than can be used on tracks, or when the subway approaches a river under which it is to be carried, greater depths of cover are secured, which may at times be so deep that tunneling is used. It is therefore evident that with the shallow type of subway which we are building, serious interference results with the underground structures, such as gas-mains, ducts for lighting, telephone cables, water-mains, steam-mains, pneumatic tubes and sewers, requiring at times radical rerouting and rearrangement of these structures. Next to sewers, and ducts with cables within them, the greatest difficulty and expense is entailed with water-mains. These, normally, have 4 feet of cover and most of them vary in size from 12 to 48 inches in diameter. Therefore, with about 6 feet of cover over the subway, interference with the larger water-mains often results. This is particularly the case at street intersections where the structures on the avenues and on the intersecting streets occupy different levels.

Difficulties with Water-Mains

Every engineer and contractor engaged in subway construction has a wholesome respect for the water-main and realizes that a break, especially in a main of large size, means serious trouble and damage. Therefore, every precaution is taken to support water-mains properly and they are carefully watched, a calker being on hand to correct any small leaks that may occur. A 48-inch water-main is looked upon with the same degree of respect as is a dynamite magazine and is believed to have about the same potential power for damage

if it should "let go." The damage cannot be lightly regarded, because breaks have occurred from time to time which have flooded the construction workings and on several occasions the operating subways, with serious results. If it could be done, subways would be kept away from these large mains, but that is not possible.

One of the accompanying illustrations shows the manner of supporting five 48-inch mains in Central Park West during the excavation of rock under them. I-beams, spanning the pipes, were supported on the street surface, and the pipes were hung from them by means of wire cables guyed in several directions to prevent lateral movement as well as vertical settlement of the pipes while the rock was blasted and removed below them. These supporting beams were an obstruction to the street surface, but it was considered better to endure this than to risk supporting the pipes from below, as it was feared that the blasting might knock out the supports, with disastrous results. We will all be glad when these five pipes are permanently supported on the subway roof. This is but one of the many interesting details of water-main support which can be seen in this work.

Along the line of the new subway now being built in Manhattan from Fulton Street to Washington Heights, a length of about 15 miles, there exist about three miles of high-pressure water-mains and about 30 miles of low-pressure mains, ranging in size from 6 to 48 inches. The high-pressure mains extend only as far north as 34th Street. Not all of these mains are interfered with, but most of

them have to be supported, relocated, or even replaced in their new positions with new mains. In some instances the water-mains have to be rerouted through different streets.

Where new mains have to be laid, they are made to conform to the standards and requirements of the Department of Water Supply. Recently, in cooperation with that department, the Board of Transportation has been using steel pipe more extensively than heretofore for the larger sized mains. This has been done to reduce failures in pipes which, it is feared, might occur where mains are laid in disturbed material or fill. Cast iron pipe, if subjected to excessive strain, fails without warning, whereas steel will deform without failure. Cast iron mains fail suddenly and cause a great deal of damage, whereas steel pipe gives warning of deterioration by leaks through cracks or pinholes which may have developed, so that the steel pipe can be replaced before any material damage results. The repairs of cast iron pipe must be done at once when failure has occurred, which always prove expensive. Steel pipe can be repaired after the situation has been studied, if the leakage is slight, and the repairs can therefore be made more economically.

The construction contracts make suitable provision for the care of the water-mains and other utilities and the requirements concerning them are clearly outlined there and in the drawings. Further provisions are made in the new contracts to avoid failures of water-mains where laid in back-fill. At such locations, the mains, whether of steel or cast iron, may be

FIVE 48-INCH
WATER-MAINS
ABREAST IN A PORTION
OF THE SUBWAY
CUT IN CENTRAL
PARK WEST,
NEW YORK
CITY



WATER MAINS IN MANHATTAN ALONG NEW SUBWAYS																	
LENGTH OF SUBWAY IN MILES-15																	
CONTRACT ROUTE SEC.	HIGH PRESSURE				LOW PRESSURE												TOTAL
	12"	16"	20"	24"	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	48"		
101	1	2900	400			400			1800	2300	400	100				8700	
"	3	1200	400		100	2900			1800		2800					9200	
"	4	1400		200		1500			700							3800	
"	5	3000	100	100		400		400	2800		200					7200	
102	1	1000			100	1500		900	800				100			5100	
"	2	700		400	300	2700			2400		100					6800	
"	3	600		900	1200				3700		200				500	7500	
"	4					1000			2900				1900		100	5900	
"	5					900			4200		600		2500			8200	
"	6					400			2900		500		3000		1000	8600	
70	1					300			2300				2900		2800	8300	
"	1-A					100			1200		1500		800	800	3900	8300	
"	2					400			1400		900		100	2800	800	6400	
"	2-A					400			2300		100		100		2500	5400	
"	3					1700	100		3100						600	5500	
"	3-A					1400			2800		100					4900	
"	4					100			2700							2800	
"	4-A					3200			900							4100	
"	5					6000			100							6100	
"	6					5000			1900		100			500		8900	
"	6-C					1200			1000							2200	
"	7					100			3200				100			3400	
"	8								2900							2900	
105	1					1500			1700		100					3300	
"	2					2200			2300		100					4600	
"	3						200		1500							1700	
106	1					2500			200		300					3000	
"	2					2700			2500		200		100	200	400	6100	
"	3					1500			100						100	1700	
207 th ST. YARD								3600	2600		4000		500			10700	
TOTAL		10000	1100	1600	1700	300	4000	3900	1300	60700	2300	12200	100	12100	4300	4100	179500

supported from either the subway roof or undisturbed material by means of a concrete cradle carried on a reinforced concrete trestle, consisting of a floor with piers about 10 feet apart.

When the cover of the subway is small or the main is large, it is necessary to carry the main through a depressed bay in the subway roof with a vertical reverse curve at each end. If the top of the pipe is less than three feet from the surface, the pipe is protected against shocks from roadway loading by means of a reinforced concrete slab above it carried by a pier on each side of the pipe to the subway roof.

Water Services

Ventilating chambers are provided for the subway at comparatively frequent intervals. These chambers lead from the subway roof to the sidewalks or park area where the openings are covered with gratings. These interfere at times with various services to buildings. At intervals, spaces called "blind bays" are left between the ventilating chambers so that most of the services can be kept outside of and independent of the railroad structure. At times this is not possible. In such cases ferrules are provided through the ventilators through which the services are carried. With water services through ventilators, additional precautions are

necessary to prevent freezing from exposure to the atmosphere in severely cold weather. After an exhaustive investigation carried on in a cold-storage plant, checked by calculations, a design has been developed for protecting exposed water services from freezing. This consists of increasing the water service to a minimum size of two inches carried through a ferrule covered with three layers of 1-inch hair felt and tar paper, the whole protected with an outside 10-inch steel ferrule. This construction is extended at least two feet into the adjoining ground on each side of the ventilating chamber.

Location of Central Park West Subway

Between 59th and 110th Streets the new subway is located under Central Park West. In this stretch we have encountered about 30,000 feet of water-main, of which about 8,800 feet is 48-inch pipe, 3,800 feet 36-inch pipe, and 4,200 feet 30-inch pipe, the remaining pipes varying from 12 to 20 inches. The subway structure in this location was designed and located with particular reference to the existing water-mains. The subway was made of two levels each having two tracks, to reduce the width of the structure, thus avoiding as far as possible any interference with the mains. North of 94th Street the railroad is located on the west side of the avenue, because there are

four to five 48-inch mains on the east side between 100th and 106th streets. South of 92nd Street, the subway is located on the east side of the Avenue, because of water-mains and underground structures which lie mostly on the west side. North of 106th Street the subway was gradually changed from two levels to one level and was continued north of 110th Street in Eight Avenue rather than turning to the west, because of the existence of six 48-inch water-mains in Manhattan Avenue, one block west of Central Park West.

In Central Park West, between 85th and 90th Streets, two abandoned 72-inch cast iron pipes were uncovered by the subway excavation. These pipes originally led from the gatehouse, at about 92nd Street and Columbus Avenue, to the Central Park Reservoir and gave considerable trouble. They were finally replaced with three 48-inch cast iron pipes, two in Central Park West and one in 85th Street.

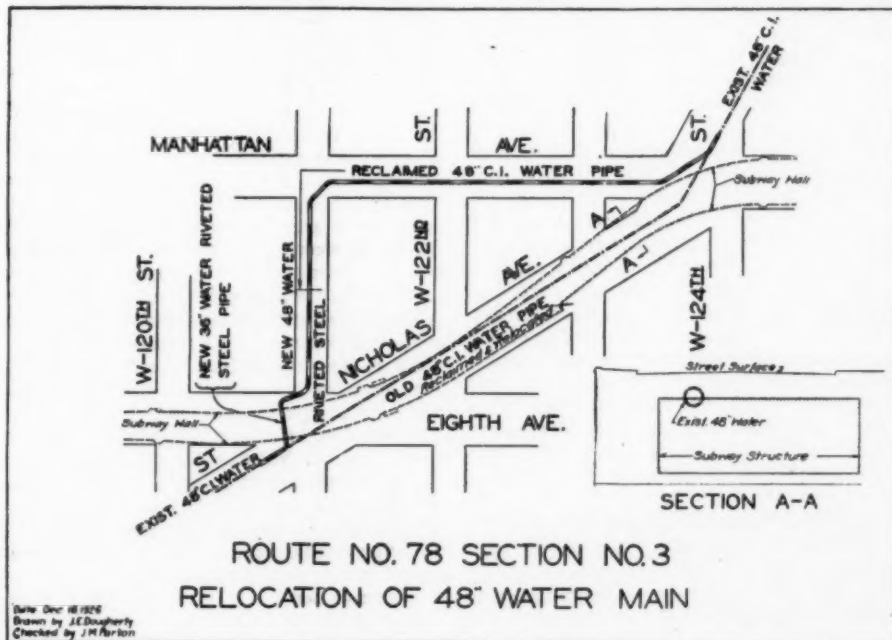
Edward Wegmann in his "Water Supply of the City of New York," pages 77 and 78, gives the following account of these pipes:

"Changes of the Aqueduct from 85th to 92nd Street.—An Act passed by the Legislature in 1865 obliged the Croton Aqueduct Department to remove the masonry conduit from 85th to 92nd Street, where it was considerably above the level of the adjoining lots and interfered with the grading of the streets, and to substi-

tute for the same, iron pipes laid below the ground, or a depressed masonry aqueduct. This measure, which had been contemplated for some years, had been steadily opposed by the Croton Water Board, which claimed that all damages caused to the lots through which this high part of the aqueduct passed had been paid for when the work was constructed. At that time, however, no person anticipated the wonderful growth of the city. The change, although expensive, was a great improvement. The masonry conduit was torn down within the limits mentioned above and was replaced by two lines of cast iron mains 6 feet in diameter. * * * The connections of the masonry conduit with the pipes were made by suitable masonry chambers.

"The contracts for the materials and work were made in the latter part of 1864 and the work was commenced in 1865. The pipes were furnished by S. Fulton & Company, of Philadelphia, and R. P. Parrott, of the West Point Foundry. The contract for grading the line and for laying the pipes was awarded to F. L. Brown and John Wetherell, of New York.

"The cost of making the change was estimated at \$310,000, but exceeded this amount on account of the breaking of some of the pipes when subjected in the summer of 1867 to water pressure for the first time. Out of 480 pipes, 18 were cracked at the hub and 1 at the spigot end. The cracks varied in length



from 2 to 33½ inches, with the exception of two which were respectively 3 feet 8¾ inches and 8 feet 9 inches long. They varied in width from a merely perceptible line to ¼-inch. The cracks occurred invariably for their whole length in or near the center of the bottom of the pipe. The broken mains were repaired by cutting off the hubs and pipes as far as the cracks extended, replacing them by strong cast iron sleeves and, where required, by short lengths of pipe.

"Various theories were advanced to account for this failure. The facts in the case were fully discussed by A. W. Craven, at that time Chief Engineer of the Croton Aqueduct Department, in a paper read before the American Society of Civil Engineers on January 29, 1868. Mr. Craven inclined to the opinion that the failure was due to water ram caused by shutting the inlet gate while the outlet of the pipes was closed. It does not seem, however, that any great water ram could have occurred. The maximum 'head' was only 14.54 feet; the inlet opening had an area of 2¼ square feet; while the area of the two 6-foot pipes was 66.5 square feet. Great care was taken in filling the mains. In the paper mentioned above, Mr. Craven states:

"Whatever be the real cause of this failure, I am convinced that if large pipes must in any case be used, an alteration should be made in their shape. If again obliged to use pipes of this calibre under similar circumstances, I would increase the thickness to 2 inches. This would diminish the chance of injury during the cooling of the metal. I think, also, that in pipes of very large size additional security would be insured by dispensing with the hub or bell ends and using sleeves as the means of making the joints."

"The 6-foot pipes which were laid at the place in question had a thickness of only 1¾ inches. The foundations upon which they were placed consisted principally of street embankments into which large stone and earth had been dumped without any special care. Mr. Craven states, however, that no settling of any account had occurred when the failure took place and that some of the pipes ruptured had been laid on rocks. Breaks in the 6-foot mains continued to occur until finally the Department of Public Works replaced these pipes with three lines of 4-foot mains."

Water-Mains within the Subway

Efforts to avoid carrying water-mains within the subway railroad have succeeded in all cases, except in the old subway under Lafayette Street, at Spring Street and Bleeker Street

stations. This subway was built at these locations with very little cover over the subway and little clearance at the sides of the stations to the building lines, so that the 36-inch water-main in this street was located under the east platform of both the Spring and Bleeker Street stations. Diverting the main through another street was considered too expensive. Breaks have occurred in this 36-inch main at various points at the normal depth with about 4 feet of cover over it. No breaks have occurred in the portion under the platform. In about 1910 the water-mains under the platforms were strengthened by surrounding them with concrete, to reduce the danger of a break and consequent subway flooding, which would be most serious. In the early part of 1921 an additional gate was installed on this main at Broome Street, making it possible to shut down the main under the station by closing eight valves, whereas previously at least fifteen valves had to be operated. In connection with the break in this line on April 23, 1921, it was necessary to close seventeen valves, which took 80 minutes. Additional valves must be closed to relieve pressure on the main gates. The main under the platform has a solid bearing and no concern is felt by the Department of Water Supply for its safety.

Croton and Catskill Aqueducts

The old Croton Aqueduct has been encountered on the new subway at two points, namely St. Nicholas Avenue from 153rd to 154th Street, and at Central Park West at 92nd Street. The old aqueduct was built of brick and rubble masonry, of horseshoe section, 8 feet 5½ inches high by 7 feet 5¼ inches wide. This is being replaced at the points of interference across the subway roof by 96-inch steel pipe, ¾-inch thick, lined with 4 inches of cement mortar and enveloped with about 8 inches of concrete. The grade of the subway was kept down to permit this construction. The new masonry section connecting the steel pipe with the old undisturbed aqueduct will be of reinforced concrete of the same interior dimensions as the old aqueduct. About 360 feet of new aqueduct is required, of which about 100 feet is steel pipe, as described. The new Croton Aqueduct in Amsterdam Avenue at 162nd Street and St. Nicholas Avenue, is a circular masonry-lined pressure tunnel, 12.25 feet in diameter, and has 140 feet of cover. The new St. Nicholas Avenue subway now under construction crosses over it without interference, the depth of the subgrade being somewhat less than 50 feet.

The depth of the Catskill Aqueduct is so

great that the subway workings do not approach it except at several of the shafts. At such points the subway was located so as not to interfere with them. The drains from these shafts, which discharge into the nearby sewers, have had to be relocated on account of subway interference.

In Brooklyn and Queens, considerable study has been given to fixing the relative locations of the Catskill steel conduits and the subway structures. The steel conduits vary in size from 48 to 72 inches in diameter. In Queens, along East Avenue, a 72-inch steel conduit was located under the sidewalk, at East Avenue and Jackson Avenue, to allow room for a further subway. In Ely Avenue the conduit was terminated near Nott Avenue on account of the proposed subway in this avenue. The conduit in East Avenue was built as an inverted siphon under the existing I.R.T. subway in Fourth Street.

Care of Other Subsurface Utilities

Before the subway work is placed under contract a careful survey is made of the subsurface conditions, as far as it is possible to do so, and the information is plotted on a scale of 10 feet to the inch, the drawing being furnished to the bidders. Of course, the information cannot be guaranteed, but it generally is correct. Incidentally the work of preparing the information for the bidders is quite burdensome because of the complicated subsurface conditions.

The contracts for subway construction require that the streets be decked so that the usual traffic can be carried on over the excavation. After the pavement is taken up and the first shallow cut made, the decking is placed, the remainder of the work being carried on under this deck. Before the decking is placed, however, a temporary by-pass gas system is installed, the service-mains being laid in the gutters and the house connections carried to them. The larger mains are carried on trestles over the sidewalks or in special locations on the sidewalks. It is the inflexible rule to have no live gas-mains under the street decking. This by-passing system is a considerable item of expense, but it is justified on the ground of pub-

lic safety.

As the excavation is made, it is necessary, of course, to support the subsurface utilities encountered, and the timbering of the trench is designed with this in view. Usually the sewers are broken out and spiral riveted pipe substituted for them. The water, gas and steam-mains are supported on the temporary timbers or steel supports, the telephone and electric line ducts are broken away, and the cables are either boxed or carried in some other way that will preserve them from injury, as far as practicable. The contracts require that all of these utilities be maintained in a condition to furnish their usual service and to the credit of the contractors it should be said that there has been little cause for complaint in this respect. It is very unusual for any service to be out of commission. The contractors have developed many interesting and efficient methods of support.

In the course of subway construction during the past twenty-five years, hundreds of miles of water-mains have been exposed. When the work was begun in 1900 it was the idea of others beside myself that we would discover wholesale leaks in these mains and that seemed to be the general impression of the times. These wholesale leaks were not found and, based on an experience covering over a quarter of a century, I have a great respect for the engineers past and present who installed the water-mains underlying the streets of New York. The leaks disclosed in our excavations have been remarkably small in number and size. I think this is an excellent showing, considering the fact that the mains were laid by many men at many times, covering a period of sixty years or more. The standards of the Department must have been good to achieve such results.

I wish to acknowledge my indebtedness to S. D. Bleich, Assistant Division Engineer of the Board of Transportation, for his assistance in assembling the facts given above. Mr. Bleich acts as Designing Engineer in charge of studies for rearrangement of the sewers, water-mains and other subsurface utilities with which the subway construction interferes.

ACKNOWLEDGMENT.—Prepared from a paper read before the New York Section, American Water Works Association, in New York City, with some additional data.

Front Cover Illustration

WE are indebted to the Joseph Dixon Crucible Company, Jersey City, N. J., for the interesting sketch by Earl Horter, made with a Dixon Eldorado pencil, which appears on the front cover of this issue. The illustration shows the Ocoee Dam under construction. This dam is situated on the Ocoee River at Parksville, Tenn., and

is operated by the Tennessee Electric Power Company. The dam is of the cyclopean gravity type and contains 160,000 cubic yards of concrete. The hydro capacity of the dam is rated at 30,150 horsepower, and the steam capacity at 20,100 horsepower. The plant equipment includes five horizontal twin-type S. Morgan Smith turbines.

A Construction Work Check List

By L. K. REINHARDT

Construction Engineer, California Industrial Accident Commission

OVER two years ago *California Safety News*, the mouthpiece of the California Industrial Accident Commission, printed on its first page the slogan, "Stop Accidents! I am telling you we can." Evidently this message reached home, for many of the larger contracting companies in California have practically made accident prevention a part of the firm's policy. For example, one company is offering a bonus to its superintendents on the completion of a building without any fatal accidents. Another will not employ as superintendent a man with a bad record as to injuries on his previous job. A third goes further, with instructions to its superintendents and foreman as follows: "Your first order is 'Prevent Accidents.'" A man is detailed to make inspections and he, together with his direct superior, is held strictly accountable for accidents which occur on the job by reason of improper or unsafe conditions, defective construction materials, tools, or appliances, or bad practice.

The third firm mentioned also has a most commendable policy in its relations with its customers and in relations between management and men, "Do unto others as you would justly have them do unto us," a policy which calls for straightforward statements and cordial cooperation. It is a basis which will succeed externally with the public and internally as an organization.

So impressed am I with the trend of many contracting firms toward a study of hazards of construction work and how to prevent accidents that I have listed below twenty-five likely hazards which are used as the foundation of inspection work by the Safety Department of the Industrial Accident Commission, on construction jobs. If these conditions are not allowed to exist the employer will have mechanically complied with the intents of the General Construction Safety Orders of the Commission and can feel assured that no claims for serious and willful misconduct will be sustained against him. This list of hazards may well be studied by contractors in other states:

1. Have the banks and walls of the excavation been properly secured by sufficient shoring?
2. Have the walls and foundations of adjoining property been properly underpinned and

shored?

3. How are materials stored on sidewalks or public ways?
4. What is the condition of the under framing of bunkers and runways? Is the soil capable of sustaining the superimposed load?
5. Have the moving parts of engines, pumps, or other machinery been safely guarded?
6. Are areas, over which construction or demolition work is going on, protected by a well-built canopy?
7. Are proper warning signs posted at dangerous electrical equipment, material hoists and elevators?
8. Are warning signs posted: "Do not ride on the material cages"?
9. Are the warnings given on these signs enforced?
10. Are all scaffolds and runways carefully built, sufficiently strong, provided with proper guard rails, toe boards and screens to prevent material falling from these scaffolds?
11. Are substantially built canopies provided over all lower tier scaffolding?
12. Are men allowed to work one above the other without head protection?
13. Are men allowed to work under material or loads being hoisted?
14. Are all holes through the floor properly or substantially covered?
15. Are all floor openings and elevator hatchways carefully protected with guard rails? Are these railings replaced when removed?
16. Are all ladders passing from floor to floor of proper construction? Are the tops and bottoms of these ladders secured against displacement? Do the ladders extend two feet six inches above the floor landing?
17. Are all appliances, cables, etc., used for hoisting material, carefully and regularly inspected?
18. Has material been piled so it will not topple over or be dislodged by the wind?
19. Has the material tower been sufficiently anchored to take care of wind or boom stresses?
20. Have loose material and boards with protruding nails been cleaned up or are they still lying around where they fell?
21. Is there sufficient light on stairways or passageways?
22. Has a guard been provided for the circular saws?
23. Have hoisting engineers been selected with a thought as to their experience and dependability?
24. Is there a first-aid cabinet on the job?
25. Have all the accidents on the job been promptly reported?

How One Contractor Handles Large-Scale Sewer Construction

Description of Work of George Pontarelli in Indiana

WITH the completion of his Evansville, Ind., contract, this last season, George Pontarelli successfully completed almost a million and a half dollars' worth of sewer construction in a little over two years. In 1924 he started work upon the construction of the sewer for the city of South Bend, Ind., which involved the laying of 16 miles of pipe at a cost of \$375,000. At Gary, Ind., his organization completed two jobs, one at a cost of \$200,000 and a small one at a cost of about

The contract called for the laying of all sizes of pipe, ranging from large concrete pipe, 72 inches in diameter, to 6-inch vitrified pipe, the latter being used for house connections. The excavation lay through sand and gravel, a great deal of which is found in this section. The trenches varied in depth from 6 feet to 30 feet. In digging the trenches for the larger pipes—that is, for from 30- to 72-inch pipe—the work was handled by a Bucyrus 30-B dragline, the machine backing away from the cut and de-



STEAM TRENCH MACHINE AT WORK ON PLEASANT STREET, RIVER PARK, IND.
The $\frac{3}{4}$ -yard shovel is moving the spoil back here as the banks were too high

\$15,000. At Michigan City, he put through a \$115,000 job and his organization has just completed a \$707,000 job for the city of Evansville, Ind.

Sewer Construction in South Bend, Ind.

In South Bend, Ind., George Pontarelli's work lay in the suburban district known as River Park. This district, which has developed phenomenally in recent years, gives an accurate indication of the thriving growth of that city. The area in which the sewer construction lay, amounted to 803 acres.

positing the material on either side of the ditch. The trenches for the smaller pipe were handled by two Austin trenchers, one a steam machine and the other gasoline driven. The trenching machines made cuts as deep as 14 feet, and when deeper work was required, either the 30-B was called into play or a smaller $\frac{3}{4}$ -yard steam dragline did the work. The trenching machines as well as the draglines deposited the material on the sides of the trench, and when the laying of the sewer pipe was completed, two Buckeye backfillers did the trick.



PART OF THE
BACKFILLING AND
GRADING OUTFIT ON
THE RIVER PARK
JOB

BUCKEYE
TRACTION DITCHER
DIGGING TRENCH
26 FEET DEEP AND
7 FEET WIDE



A CLOSE-UP OF
THE 72-INCH PIPE
LAID IN RIVER PARK

Note sand bags piled
around top of pipe to hold
back-fill

SECTION OF
96-INCH PIPE WEIGH-
ING SEVERAL TONS
BEING LAID BY BUCYRUS
50-B DRAGLINE



$\frac{3}{4}$ -YARD SHOVEL
BACKFILLING AT
JUNCTION CHAMBER
ON RIVER PARK
JOB

GATE PLACED
IN END OF PIPE
TO PREVENT FILLING UP
FROM SLIDES DURING THE NIGHT





GASOLINE DRAGLINE AT WORK WHERE 48-INCH PIPE WAS LAID AT A DEPTH OF 20 TO 22 FEET

Surplus Material Disposed of Profitably

In many sewer construction contracts, the efficiency with which the surplus material is disposed of is often the factor which decides whether or not the work will be completed with profit. On the River Park job, Mr. Pontarelli proceeded in a novel way. He purchased a number of low-lying lots and with the surplus earth filled them up to grade, thus getting a dump for his spoil and increasing the resale value of the real estate investment. This spoil was handled from the sides of the ditch by an Erie steam shovel and hauled away to the lots in motor trucks.

In some cases real heavy digging was encountered by the trenching machines, and this occasionally resulted in the spoil banks being too high. This was overcome by placing a shovel alongside the trencher, the shovel moving the material back from the edge of the cut.

Trench Promptly Backfilled

The work was so organized that only from 30 to 40 feet of trench was kept open at a time, backfillers following close upon the gang laying the pipe. To avoid inconvenience caused by backfilling too close to the pipe-laying gang, in the case of the larger pipe, sand bags were laid around the top of the new-laid pipe to hold back the back-fill. As new sections were laid, these bags were moved forward. The joints on the larger pipes were handled by placing a steel form inside and pouring liquid

mortar into the joints. This method of handling the joints proved very satisfactory and Raymond L. Pike, Engineer and Superintendent on the job, reports that some unusually excellent results were obtained.

Much Water Encountered on Job

In addition to the sand and gravel which constituted the greater part of the material removed, occasional hard clay and water-bearing sand were encountered, which added considerably to the difficulty of the work. At one point, four No. 4 Domestic diaphragm pumps were kept constantly at work pumping the water from the trench. The quantity removed was enough to tax the capacity of these machines.

Six-Inch Connection Laid Under Permanent Pavement Without Cutting Surface

On Jefferson Boulevard a pavement of a permanent type had been laid, although no curbing or sidewalks were completed. Here, the street was 85½ feet wide and the sewer was laid about ten feet from the edge of the pavement, which was only 18 feet wide. Since the



CLOSE-UP OF DITCH DUG FOR 57-INCH PIPE

pavement was new, every precaution was taken to keep from injuring the surface or the foundation. This problem was somewhat complicated, as it was necessary to carry thirty-six 6-inch house-connections as well as eight 8-inch inlets, across the street. The pipe was placed by using cast iron water-pipe, forcing it through the soil under the foundation course of the pavement with two 25-ton jacks. Pits were dug at the side of the pavement and two sections of pipe, one 6 feet and one 12 feet, were forced across the street by the heavy jacks.

In addition to the laying of the pipe a large junction chamber was built at the corner of

Excessive Water Encountered on Gary, Ind., Job

At Gary, Ind., the Pontarelli organization completed Trunk Sewer No. 47. This, although a somewhat smaller job than the River Park sewer, amounted to \$200,000. An unusual amount of difficulty was encountered because of excessive water in the deep cuts. The water was so bad that when the equipment was finally rigged, 125,000 gallons a day were removed from the trench. The water was taken care of by well-points sunk along the sides of the trench at intervals of about two feet. Many methods were tried to sink these well-points. Driving was not successful and drilled holes filled up be-



DRAGLINE LAYING SECTION OF 72-INCH CONCRETE PIPE ON THE RIVER PARK JOB, SOUTH BEND, IND.

22nd and Wall Streets. This concrete chamber was 27 feet long, 11 feet wide and 7 feet deep. The top of the chamber was 18 feet below the surface and was built to take care of 54-inch, 47-inch and 72-inch pipe. Raymond Pike, who is now Assistant Engineer in Charge of Construction at South Bend, Ind., was Engineer and Superintendent on the job. Frederick J. Anderson was City Engineer in South Bend and Robert Gehes was Inspector. Mr. Pontarelli personally supervised a great deal of the work and was on the scene of operation whenever possible.

fore the pipe could be put in. The successful method proved to be the water-jet method with a pressure of 150 pounds. A total of 650 well-points were sunk. In addition to the laying of sewer pipe by the trench method, 1,585 feet of tunnel work were necessary.

The Evansville, Ind., Contract

The Evansville, Ind., job was the largest contract handled by the Pontarelli organization. The work was the construction of the Howard Roosa sewer in Evansville, which will serve an area of about two square miles. The total

amount of the contract was \$707,000 and called for 17,760 feet of sewer made up of 3,350 feet of 102-inch, 3,950 feet of 96-inch, 2,700 feet of 90-inch, 2,900 feet of 72-inch, 650 feet of 66-inch, 4,460 feet of 60-inch, 1,100 feet of 57-inch, and 650 feet of 48-inch pipe. In addition to the laying of the sewer pipe, the contract called for 120 catch-basins and sixty man-holes. Digging averaged about 15 feet deep and ran as high as 38 feet deep.

The contract time for the Evansville work was two years, but Mr. Pontarelli is putting the work through at such a speed that the entire job will undoubtedly be completed in the spring of this year—about one year ahead of the time limit. Were it not for the fact that work was delayed through quicksand and by backwater from the flooded river, the work would probably have been finished in eight months instead of the two years allowed.

For the Evansville job, five Bucyrus draglines, two 50-B machines, two 30-B and one 20-B, all steam-driven and Crawler-mounted, and one gasoline Buckeye traction ditcher capable of digging a ditch 20 feet deep and 7 feet wide, were used.

On larger sizes of pipe, and where room permitted, one dragline worked alone, opening the cut, followed by a second machine, which handled the sections of pipe and did a certain amount of backfilling. The spoil, and occasionally part of the back-fill, was left on the sides of the cut to be handled later by one of

the draglines. The spoil was hauled away to the dump by local contractors. The machine which handled the pipe was also equipped with an Owen clamshell bucket with which, when necessary, the bottom of the trench was trimmed.

In laying the smaller sizes of pipe, the ditcher worked with the small dragline. The ditcher opened the trench and deposited the spoil along the sides. The dragline, operating as a clamshell with a Williams bucket, or as a crane, cleaned out the bottom of the trench, where necessary handled the sheeting and the sections of pipe, and did the backfilling. The work lay through yellow and blue clay with an occasional pocket of packed sand, but the dragline machines working on the large pipe, two working as a unit, averaged 100 feet of 102-inch pipe a day, with a maximum of 165 feet. The ditcher, together with the smaller half-yard clamshell machine averaged about 110 feet of 60-inch pipe a day, and completed a maximum of 140 feet per day.

On the Evansville sewer, M. E. Boelson was civil engineer on the work including from 60- to 48-inch pipe, and G. W. Jackson was engineer on the construction involving larger sizes. The foremen of the pipe-laying gangs were Anthony Pontarelli, B. F. Lentz and Tom Eaton. The foreman on the bricklaying job was Fred J. Reheman. A second of George Pontarelli's sons, Eddie Pontarelli, acted as timekeeper on the entire job.



**DIGGING
THE DITCH FOR
96-INCH PIPE IN
EVANSVILLE**

The Bucyrus 50-B dragline in the background is digging to a secondary level preparatory to moving down and digging to full depth. The 50-B in the foreground will then move around to the rear and carry on the operations.



WORK ON TRUNK SEWER No. 47 AT GARY, IND

Note 4-inch suction pipe with well points placed at close intervals along the side of the ditch

We are indebted to *The Excavating Engineer* for the material and illustrations from which this article is prepared, the original material

having been furnished through the courtesy of the contractor, George Pontarelli, and his engineers.

A Manual of Oxy-Acetylene Welding and Cutting

THE Oxwelder's Manual containing instructions for welding and cutting by the oxy-acetylene process is now in its ninth edition. This book, which has been completely rewritten, is published by the Oxweld Acetylene Company, Long Island City, N. Y., and is sold at \$1.00 a copy. The publishers, not being satisfied that the eight editions through which this book ran were representative of the best modern practice, had the ninth edition rewritten from cover to cover, producing an entirely new manual. In successive chapters, the following topics are discussed and illustrated: historical development of oxy-acetylene

welding; oxygen and acetylene; the process of oxy-acetylene welding and cutting; equipment for welding and cutting; blow pipes; regulators; accessories; cutting; welding sheet steel; steel plate; steel pipe; cast steel; welding practices for cast iron; welding large gray iron castings; bronze-welding of cast iron and malleable iron; welding brass and bronze; welding monel metal and castings; welding sheet aluminum; welding cast aluminum; high carbon steel and alloy steels; welding copper; Stellite; cutting heavy steel sections and heavy cast iron sections; precautions and safe practices; shop layouts and organization.

New Lakewood Distributor

THE Lakewood Engineering Company, Cleveland, Ohio, has announced the appointment of the Superior Supply Company, Webster Building, 327 South La Salle Street, Chicago, Ill., as distributor for Lakewood equipment in the river counties, Iowa, northern Illinois and the

northwest portion of Indiana. A. N. Herrick, Manager of the Lakewood Engineering Company's Chicago office, now closed, continues as District Supervisor for the Central West territory and will make his headquarters at the Superior Supply Company.

A Contrast in Methods and Costs of Excavation

How One Excavation Job Was Handled and How It Should Have Been Handled

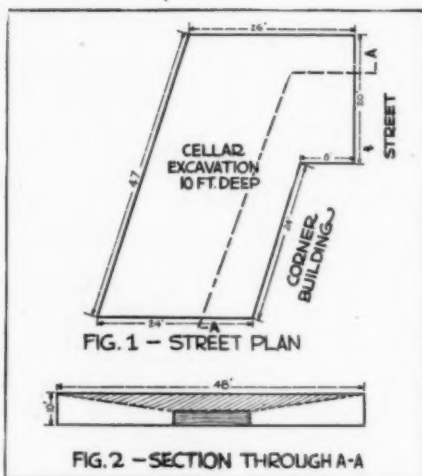
By DANIEL J. HAUER
Construction Economist

MOST contractors are satisfied with simply making some profit. This may be partly due to the fact that on many jobs money is lost, so that any job that nets a profit, large or small, may be considered a success. We find a similar thought in the real estate and commercial fields in the adage, "No man ever made a mistake in selling and taking a profit." In many cases this is wrong, for business men have often "sold, only to repent." True, they made a profit, but those who bought resold making ten times or more in profits than the former seller.

So it is in contracting. A profit is the goal, but the great question should not be, was a profit made, but rather, was all the profit made that was possible. The answer to this is too frequently in the negative, and in many cases the contractor has not known that a larger profit could have been made, for the question is neither asked nor answered and he may have no standard by which he can judge, or, having a standard, he may have neither the time nor inclination to make comparisons. Further, he may not be fair minded enough to judge his own work and endeavors and condemn his own methods, so he goes on indefinitely making some profit, but not making all that is possible. The writer sees cases of this kind in New York City and elsewhere time after time, among contractors operating on both large and small jobs.

A single example may be valuable in helping to teach this lesson. An excavation job for a small stone building was started in the early winter in the lower section of New York City. The lot was irregular in shape and fronted on two streets, making it quite easy to get to the work. It was also possible to take a wagon in at both ends and to handle the job in a very satisfactory manner. The dimensions and shape of the lot are shown in Figure 1, and a section is illustrated in Figure 2.

There were 490 cubic yards in the cellar, which was dug to a depth of 10 feet. The contractor figured the job for hand excavation to be loaded into wagons and hauled to scows. The price he obtained netted a profit on the job. In considering this work, the cost and methods of loading are the only features we need describe, for the hauling costs would have remained about the same if wagons were used



with any method, although, if a power loader had been used, trucks might have reduced the cost of transportation. Our object, however, is to show how the methods of excavation could have been improved upon.

The soil removed was a sandy clay that stood up without shores, but it was not difficult to loosen and but little picking made fairly easy shoveling. Wagons were driven into the lot and loaded directly by hand and when loaded drove off at the other end of the lot. In this manner 260 cubic yards were excavated and loaded as shown by the diagonal hatching in the sketch in Figure 2. After the soil was taken out, then the center, the part hatched horizontally, was thrown up onto the slopes of the runway and rehandled into the wagons, which were backed down the slopes from the two streets. Thus, the center was cleaned up first and the work was then carried on toward the two streets. After the center was excavated, it became necessary as the streets were approached to handle the excavated material a second time. Thus, the total amount of shoveling done amounted to between 800 and 900 cubic yards.

Even this method was a mistake, as a slope toward one street should have been maintained over which the wagons could have entered and left the pit. The end toward the other street could then have been excavated and loaded di-

rectly into the wagons working against a breast. More than 100 cubic yards could thus have been handled and more than \$100 saved on this part of the excavation, leaving only one end of the excavation to be rehandled a second and third time. By the method followed, about 230 cubic yards were handled from one to three times.

A few time-studies were made on the job. From four to six men worked at digging and shoveling. Men working on the lower lift with short-handled shovels threw eight shovel loads per minute up a distance of about 5 feet. On the upper lift of about the same height and into the dump wagons that measure 4 feet 8 inches in height without sideboards, the men threw seven shovel loads per minute. These men should have handled ten or more shovel loads per minute. This is the theory of such shoveling, but it never works out when the same number of men shovel on each lift, for the extra dirt is not there for them to handle. These men feel that they are doing enough when they keep their dirt cleaned up. However, if three men shovel to two, then the two will handle more earth. The writer has tried this out extensively and has had four men on a lower lift to loosen and shovel to three, who handled all the earth given them. These three men kept two men busy on the third lift, so that five men rehandled on the two lifts the same amount of material shoveled by four men on one lift. This again reduces the cost of such work, but it is a detail to which few contractors give much attention, although in digging trenches and small pits on many large jobs, such hand work is still done extensively.

The earth handled on this job weighed about 95 pounds to the cubic foot and the men carried about 12 pounds to a shovel-load on their round-pointed short-handled blades. This meant 216 shovels to a cubic yard. Thus, if the men could have worked steadily, they would have handled about a cubic yard in 30 minutes, but men doing such work must spell themselves from 25 to 40 per cent of the time, unless they have some pace-making machine or are paid a bonus. Consequently, these men shoveled about 10 cubic yards a day. This proved to be the amount they averaged in loading directly into wagons. Taking into consideration the rehandling of the earth, however, the men averaged from 5 to 6 cubic yards place-measurement in a day. This was verified by there being about 150 man-days' work done on the job.

There is another common mistake made in hand excavation. If an economic load of from 19 to 20 pounds on the proper size shovel had been taken with each throw of the shovel, then

five instead of eight shovel-loads would have moved a cubic foot and there would have been only 135 shovels to the cubic yard instead of 216, a reduction of about 33 per cent, which could have effected a saving of about \$100 on this job.

The entire excavation work done on this job could not be considered of the best, but was about up to the average for hand-jobs and, as already stated, a profit was made. It can be seen that if, instead of hand-methods, an excavating machine had been used, the job could have been done in much less time and at a decided saving.

In New York City there are a number of crane trucks whose owners rent them out for many kinds of work. These revolving cranes are each mounted on the chassis of a truck and can handle a $\frac{1}{2}$ -cubic-yard grab bucket. A few of the larger sizes can operate even a $\frac{3}{4}$ -yard bucket. These crane trucks can be hired in New York equipped to work and with an operator, just as a truck is rented, for about \$60 per day. Such a machine under favorable conditions can excavate about 125 cubic yards per day, so it is safe to say that on this job such a crane could have excavated about 90 cubic yards per day. One man would have been needed in the pit to trim the sides down, while after the crane had worked five days, there might have been some trimming of the sides and corners necessary. Such work, judged by the cost of the hand excavation, would have cost about \$2.50 per cubic yard.

Thus, with wages for men at 50 cents per hour and for a nine-hour day, we can make the following comparisons:

Four men, 7 days = 28 days at \$4.50.....	\$126.00
Six men, 20 days = 120 days at \$4.50.....	540.00
Total	\$666.00

This made an average cost of \$1.36 per cubic yard. For machine excavation the cost would have been about as follows:

Crane, five days at \$60.....	\$300.00
One man, five days at \$4.50.....	22.50
Forty cubic yards trimming at \$2.50.....	100.00
Total	\$422.50

This would have made an average cost of about 86 cents per cubic yard, so that a saving of about 50 cents per yard could have been effected on the 490 cubic yards, or nearly \$250. The contractor doing this job looked after the men himself, so he did not use a foreman. There are many jobs of this character that can be handled in the way indicated, not only with a crane truck, but with other types of excavators that work from the top of an excavation.

Cutting Metals Under Water

By L. F. HAGGLUND

Under-Water Metal Cutting Corporation, New York City

BROADLY, the cutting of metals under water resolves itself into two classes. First, the class of work on which dynamite can be used; second, the work that must be done by a cutting-tool that will not damage adjacent structures and that will cut along a prescribed line.

The first, or dynamite, class of job consists chiefly of the removal of wrecked steel vessels or isolated metallic submarine structures. For this work, where dynamite can be used freely, it is by far the cheaper and most expeditious method. The removal of the wreck of the S. S. Canadian Recruit will serve to illustrate an application of the method. This vessel sank in the St. Lawrence River about fifty miles below Quebec, where the river is about seven miles wide. The wreck was two and one-half miles from shore, but close to the river channel, so that it was a menace to navigation and had to be removed. The Canadian Salvors undertook the work of removal. Accordingly, with a small wrecking-plant, two divers and a large quantity of dynamite, they succeeded



DIVER LYING IN PIPE, SHOWING POSITION FROM WHICH CUT AT BASE, INDICATED BY ARROWS, WAS MADE



BROKEN PIPE AND ADJOINING BELL CUT CLEAR BY UNDER-WATER BURNER

during the past summer in practically blowing the wreck to pieces and scattering these pieces so that the required depth of water was obtained at that location. In this instance, nothing was to be saved. The job was simply one of removal, and dynamite did the work. But even for success with this method, a diver experienced in the use of dynamite must be obtained, and as there are but few divers, and a very few who have had experience with explosives, getting the right man is probably the most important part of the job.

For metal that must be cut accurately under water, there has been for years the hacksaw, chisel and drill, spurred on by the right hand and arm of a diver or by compressed air. These tools sufficed until the period of the World War. At that period, 1914-1918, with the increased volume of shipping menaced by an ever-increasing number of submarines, wrecks of steel vessels became numerous. Accordingly, marine wrecking or salvage, through this volume of work, received an incentive to develop new and better methods. One need was for a rapid and reliable under-water metal-cutting tool.

The oxy-acetylene torch had come into its own for cutting and welding metals above

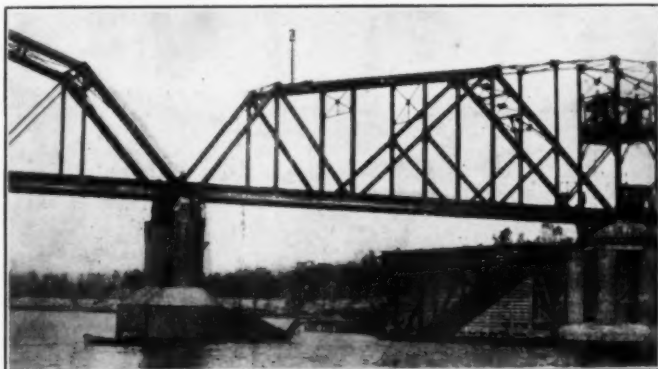
water, and, at first, efforts were made to adapt this torch for work under water. Records and reports show that on several jobs fairly good results were obtained in limited depths. In practically all of these cases an ordinary oxy-acetylene torch was used, together with some means or apparatus to displace the water from the immediate vicinity of the cutting-flame and the metal where the flame was acting. The difficulties encountered were numerous, such as the surrounding water-pressure and the increase in this hydrostatic pressure with depth. In sea-water this amounts to approximately $\frac{1}{2}$ pound per foot, or about 45 pound in 100 feet of water. Another difficulty is that at times it is actually impossible for the diver to see what he is doing and he must rely solely on his sense of touch. Aside from these things,

stant the arc was moved away, the molten metal solidified—usually solidifying in the cut, reuniting the metal. This made it extremely difficult, if not impossible, to make a continuous cut under water with the arc alone.

To overcome this difficulty and achieve a continuous cut, a jet of oxygen was combined with the arc. A carbon electrode containing several gas tubes was used. Through these tubes oxygen under high pressure was forced directly onto the metal where the arc was drawn. This combination of the electric arc with oxygen accomplished the desired results. It was possible to cut any metal under water at any divable depth. The depth of water does not affect the arc, and an increase in depth simply means an increase in the pressure at which the oxygen gas is supplied.

**HOISTING
A BENT SECTION
OF THIRTY
INTERLOCKED SHEET
PILES AFTER THEY
HAVE BEEN
CUT OFF TWENTY-FIVE
FEET BELOW THE
SURFACE, USING AN
UNDER-WATER BURNING
TORCH**

This work was done
for the Texas and Pacific
Railway on its draw-
span across the Atchafalaya
River, Melville, La.
United States
Steel 40-pound piling
was used



each job presents its own particular handicaps—a strong tide or river current, extreme cold, the presence of concrete or heavy paint on the metal, concrete in the interlock of steel piling, or a short diving-time in great depths. There is a new problem on almost every job.

The old Merritt & Chapman Derrick & Wrecking Company, of New York, understood the problem and looked at it from the diver's viewpoint. One of its men suggested the possibility of using a jet of oxygen upon metal heated by the electric arc under water. As a marine wrecking company, it had a fairly constant, though limited, demand for such a tool, and as a result of this suggestion, its own engineers and divers conducted experimental work along this line. They first believed that the heat of the arc alone could be used to cut metal under water. However, owing to the enormous quantity of water in contact with any submerged metal, as in this case of a sunken hull, the heat generated by the arc at any point was rapidly dissipated, and the in-

Subsequently, during the salvage operations conducted on the S. S. St. Paul, sunk in New York harbor in 1918, Ralph E. Chapman and John W. Kirk took out a patent on a method for cutting metals under water. This method combines the heat of the arc with the oxidizing effect of a stream of oxygen under high pressure.

The under-water metal-cutting apparatus consists of a generating unit, a switchboard and resistance, a supply of oxygen, an oxygen gage and hose, and the double conductor-hose through which both oxygen and electricity are carried to the torch. The torch itself consists of a carbon electrode twelve inches long, clamped into a brass holder at one end. Extending through this electrode are two copper tubes. At one end, these tubes are also clamped in the brass holder and at the other they terminate at the tip of the electrode. When the diver strikes an arc under water, with this torch, the oxygen is released through the arc and forced upon the molten metal. Cutting starts imme-

diately, and the speed possible depends upon the current available as well as the facility with which the diver can work. And the latter factor largely depends upon the job.

In one instance, during the early part of this year, a quantity of steel sheet-piling was to be cut, at a depth of 20 feet. When the diver was actually on the job, it was found that even in 20 feet of water these steel piles were covered with 12 inches of ice along the line to be cut. This ice had formed when the river was low and had remained on the piling when the water rose. It then became necessary to remove this ice before the piling could be reached. In another instance, where only 32 feet of 1/2-inch steel plate was to be cut, it was

found that owing to the quantity of mud and silt in the river, the diver was unable to see the work he was doing, or even the electric arc itself, at any time during the entire cutting operation.

To date, steel plate, sheet piling, cast steel, cast iron, copper and brass have been cut in depths of water down to 120 feet.

To meet a limited but important demand for under-water metal-cutting apparatus, complete apparatus and skilled diver-operators are kept on hand by the Merritt-Chapman & Scott Corporation, and can be furnished on short notice for work anywhere in the United States.

— From a paper presented at the International Acetylene Association Convention, Chicago.

New Zealand Contractor Develops Unusual Construction Method

Discovers a Submerged Forest

FROM far-away New Zealand comes a report of unusual methods employed by a contractor in the construction of huge concrete tanks for a sewage plant.

Due to the nature of the soil it was impossible to make straight-out excavation, because after digging through a layer of clay, running shingle and sand was encountered. The contractor, T. Pheloung, of Christchurch, hit upon the plan of



TANK IN FOREGROUND SUNK TO SURFACE LEVEL



CRAWLER CRANE HANDLING EXCAVATION FROM INTERIOR OF CONCRETE TANK

erecting the concrete tanks above the ground level, and then sinking them into position. Each tank measures 30 feet inside diameter by 22 feet high. A full-revolving crane mounted on continuous treads was used for hoisting the concrete into the forms. After these tanks were constructed, the ground was excavated inside the diameter of the tank, allowing the concrete structure to settle into position. The settling process was hastened somewhat by employing for additional weight, heavy railroad rails which were hoisted into place on

top of the tanks by the crane.

It is reported that the contractor has been able to sink one of these tanks to ground level, or to a depth of 22 feet, in seven hours of actual working time. Four tanks have been so placed to date, with more to follow. The machine used is an Osgood $\frac{3}{4}$ -yard heavy-duty clamshell crane. This machine has also been used for excavating several sumps of a rectangular nature, which were

placed in ground that consisted of clay and solid shingle so that concrete reinforcing was not necessary.

In the excavation of the sumps, trees were found imbedded in the clay in large numbers—evidently the remains of a submerged forest. The removal of these trees required considerable force, but, according to the contractor, the revolving crane was equal to the occasion.

No Idle Equipment for This Hustling Contractor

By MORRY WHITCOMB

WHILE covering the construction trade, I landed recently in the office of a contractor in a fairly large Middle Western city. Patiently I had listened to his recital of the terrible state of business and his efforts to cut down his overhead; very gratefully I had jotted down my rather meagre order; and we were thick in a discussion of politics in general when I walked a gentleman in search of a contractor to rebuild the sidewalk in front of his house.

The contractor quoted a price of \$3.85 per five-foot square, whereupon the gentleman raised his hands in horror.

"Can't you do any better?" he queried.

"Not on that small strip," persisted the contractor. "I could if I had a thousand feet."

"Well, why don't you get a thousand feet? Those sidewalks could well stand replacing."

The contractor promised to look into the matter and let the man know in a day or two. Here was food for reflection. The sidewalks on Townsley Avenue (the street on which the prospective customer lived) certainly could stand replacing. Built of macadam and brick some ten or twelve years ago by the man who had developed the district, they were now cracked and scarred in a manner not unlike that of the face of the moon as seen through a telescope. Their once unwrinkled surface was now about as smooth as the surface of a sea caressed by a fifty-mile gale. Here was work lying under their noses, begging to be done, while contractors warmed swivel chairs, wailed about bad business and tremendous overhead, and bid on jobs in Timbuctoo and ate up what little profit there was in the job in transportation costs.

Once having been bitten by the germ of an idea the contractor let no grass grow under his feet. Calling his estimator, he commanded, "Get your hat and coat, Frank. We're going on a tour of Townsley Avenue."

The orders weren't exactly easy to get. The property owners on Townsley Avenue didn't fall all over each other in their eagerness to sign the contracts, but they were all reasonable and willing to be convinced. Each order obtained, however, acted as a wedge, making it easier to get the next one. If Jones could afford a new sidewalk in front of his house, why, Smith was not to be outdone. He wanted a new sidewalk and driveway.

Townsley Avenue was a long thoroughfare. When the smoke of the battle had died down the contractor emerged with contracts calling for the laying of over thirteen hundred feet of continuous cement sidewalks and driveways on both sides of the street, at prices to satisfy both owners and contractor.

The rest was comparatively plain sailing. Hitherto idle equipment was brought into play. Crews trod upon each other's heels as they proceeded up Townsley Avenue, shattering the peace and quiet with the blows of their sledge hammers and the roar of their concrete mixers, but leaving in their wake two ribbons of smooth, new concrete sidewalk.

What occurred here was repeated in other parts of the city. It can be repeated in other cities and towns. My contractor friend wails no more about poor business and idle machinery rusting in his yards, and gives me orders which do not make us both blush for shame at their smallness.

Second Annual Convention of Quantity Surveyors

THE American Institute of Quantity Surveyors organized in June, 1926, with headquarters at 510 North Dearborn Street, Chicago, Ill. C. T. Burman, Secretary, is to hold its second annual convention at Washington, D. C., June 6, 7 and 8, 1927.

The adherents to quantity surveying have been

increasing rapidly during the last two years and especially since the conception of this new organization, whose aim and object is to unite the professional quantity surveyors and their associates of the construction industry for the development of quantity surveying.



EAST PORTAL OF SUNSET TUNNEL, SAN FRANCISCO

The retaining walls, portal entrance and concrete plant are shown, with the Koehring mixer to be installed at the left. The concrete plant is shown at the right just above the portal entrance, and also the power-house is shown with a Chicago Pneumatic compressor behind it. The hill under which the tunnel cuts can be seen in the background.

Sunset Tunnel as a Concrete Field Laboratory

Detailed Study of Concrete Mixes Yields Interesting Results on San Francisco Traffic Bore

By FORD WILKINS

THE city of San Francisco is digging through the base of one of its numerous high hills, in the heart of a residence district, to built Sunset Tunnel, a hole four-fifths of a mile long, 25 feet wide and 23 feet above the invert, lined with reinforced concrete. Designed for two-way street-car traffic, the tunnel will serve a large area on the west side of the city with vastly improved transportation to the business district and ferries.

Methods adopted for observing and studying the concrete that goes into Sunset Tunnel, comparable to the most detailed laboratory survey, have attracted widespread interest in engineering circles locally, and are producing results that make this particular tunnel job more than usually interesting to engineers and builders generally.

Although records and tests are not complete yet, it has already been proved that the "workability" of a mix of fixed weight and strength can be best regulated by increasing or decreasing the amount of the coarsest size of aggregate used. This and other conclusions are based not only on work at the tunnel, but on

supplementary data from tests made at the city's testing laboratory, and they bear the stamp of considerable authority.

Another interesting construction feature is the contractor's method of digging the main bore. The boiler was removed from a Marion-20 steam shovel and a compressed-air rigging attached to it. With the boom shortened, the back-end cut away and ballast thrown on, the rig has plenty of room to swing in a 26-foot radius with 4½-foot clearance to the opposite wall of the bare tunnel. It loads muck and rock directly into dump-cars hauled into the tunnel by two Plymouth gasoline locomotives.

General Description

Although the correct name for the project is the Sunset Tunnel, it is more generally known in San Francisco as the Duboce Tunnel, for it follows the Duboce Avenue route from Market Street to the Beach. The tunnel proper, 4,232 feet in length, runs from Noe Street and Duboce Avenue to Carl and Cole Streets, cutting through a ridge above Duboce Park which reaches a height of 525 feet.

The tunnel is not straight. It curves to the

left from the east portal about midway, on a radius of 511.02 feet. Out of the west portal, the route curves again to the left on a 250-foot radius. The grade varies from .040 to .030 feet on a grade line elevation of 155 feet. Net clearance above the rails amounts to 18 feet 9 inches.

The district benefited by the tunnel and assessed for its cost includes 1,129 acres, most of it in what is known as the Sunset District, a comparatively new residential section. The assessment rate, levied under the city's Tunnel Procedure Ordinance, calls for a minimum of 1½ cents a square foot and a maximum of 5 cents.

Contract and Personnel

The contract for tunnel construction was awarded on a low bid of \$1,247,592 to the Youdall Construction Company, of San Francisco, on May 10, 1926. This company is headed by Leonard F. Youdall and R. G. Clifford. The contract was signed May 24 and work began June 5 under a clause that called for completion of the job in 450 working days. It will be finished in just about a year from now. Bonds amounting to \$200,000 for faithful performance, and half of the contract price for labor and material, were signed by the contractor.

The project is under the general direction of City Engineer M. M. O'Shaughnessy, who appointed M. J. Bartell, Resident Engineer, and M. J. Callaghan designing engineer. The concrete tests previously mentioned are carried out under the direction of the Resident Engineer and C. L. Cook, City Chemist. Mr. Bartell and Mr. Callaghan furnished most of the information contained in this article.

Legal Difficulties

Here is another interesting fact about Sunset Tunnel. Work is progressing while the Supreme Court of the State of California has yet to decide on a suit for injunction to prevent the city from building the tunnel!

Suit was brought by property owners protesting the valuation placed on condemned property and involving the validity of the Tunnel Procedure Ordinance. The decision of a lower court was considered so well founded as to make the chances of a reversal in the Supreme Court extremely remote, and the city decided to go ahead and build. The appeal case will not come up for some time yet, possibly not until the tunnel is finished and open to traffic.

Driving the Pilot Drift

Soft earth, and rock of varying hardness,



WEST PORTAL OF THE TUNNEL

The section in the foreground is in open cut. The retaining walls had not been set in when the picture was taken. The pilot drift only is being worked from this end, the full heading from the East Portal. The portal entrance is to be just beyond the mixer and sheds

mostly serpentine and chert, are being encountered in digging the bore. A pilot drift, 6 by 7 feet, is shoved through at the rate of about 20 feet a day from both west and east portals with Chicago Pneumatic and Ingersoll-Rand rock drills. Rails are laid in as the drift progresses, and dump-cars carry mucked-out material back to the openings.

A winch and cable is used on the west end to haul out the cars, and the material is loaded into trucks at the end of a runway and carted off. At the east end, cars dump down into the main heading, where the shovel can pick up the material.

The Timber System

The main heading is worked from the east portal only, using the cut-down Marion shovel with compressed-air attachment previously mentioned. This shovel requires no addition to the ordinary power equipment to make it run by compressed air. The boiler, which was removed, could have been used for storing the air, but its bulk made its removal necessary in this case. Three steel tanks hold the compressed air, which is piped in from the compressor outside the east tunnel entrance.

Bench drifts or "wall plates" are mucked out ahead of the main heading, below and on each side of the pilot drift, entirely by hand. Dynamite is used to loosen the rock.

Throughout this job 12 x 12 timbers are used, laid parallel with the transverse section. Arch timbers are supported by the wall-plates and these in turn by vertical timbers. One section, about 100 feet long, had to be reinforced with extra timbers during construction because of a drift of soft earth. This section has vertical posts 5 feet apart on the center line of the tunnel, supporting plates and spreaders. A Gunit machine is being used to chink the timbers with concrete.

Only about 400 feet of drilling and mucking remains to be finished before the pilot drifts meet. This part of the work is being rushed through as fast as possible, both to provide ventilation for the unfinished tunnel and to size up the ground. Compressed air piped into the heading furnishes temporary ventilation. The main heading has reached a distance of about 1,500 feet from the east portal.

Lining and Portals

The tunnel walls have a series of deep niches 400 feet apart, almost opposite each other, with openings to the wiring system. There is also a series of shallow niches 50 feet apart and staggered.

The lining in those portions of the tunnel built through soft earth will have a thickness of 22 inches at the arch and 33 inches in the walls at spring. Portions laid in rock will have an arch 18 inches thick, uniform throughout. The invert is uniformly 18 inches thick. A Hackley concrete gun is used to apply the concrete lining. Roy C. Hackley, the inventor of the gun, is Superintending Engineer for the Youdall Construction Company on this job.

Portals on both ends are finished except for ornamental lamps. Retaining walls of reinforced concrete are built in open cut, 26 feet apart, with footings 13 feet $3\frac{1}{2}$ inches wide and walls tapering to 1 foot wide at the top, sloping down from the top of the portal entrance. Six-inch tile drains are laid in broken rock just above the base of these retaining walls.

Reinforcing Steel

In the tunnel walls, reinforcement consists of $\frac{3}{4}$ -inch steel bars spaced 12 inches apart vertically, except in a section of soft earth where they are doubled; and 24 inches apart from center to center horizontally. Both the intrados and extrados are reinforced in sections where soft material is encountered, but the intrados alone is reinforced throughout.

The contractor's equipment includes a timber trestle at the east portal, 250 feet long, with narrow-gage track leading to large bins where the muck and rock is hauled and dumped with two Plymouth gasoline locomotives. These bins load through hoppers and chutes into trucks on the street level.

A big Chicago Pneumatic compressor, powered with a 360-horse power General Electric motor, is set in the main power-house just above the east tunnel entrance. This feeds into three large steel tanks. A water tank with a cooler arrangement on top of it is used to cool the air after it is compressed.

Testing and Handling the Concrete

The concrete plant stands close to the tunnel entrance at one of the retaining walls, where a Koehring 1-yard mixer can pour down into specially constructed concrete dump-cars of 2-yard capacity each. These dump-cars designed by Mr. Hackley are fitted with pistons for compressed air for dumping, and are constructed to dump on either side of the track. They were built from Mr. Hackley's design by the Pacific Car & Equipment Company, of San Francisco.

Storage bins for the aggregate and cement

sacks are directly behind and above the mixer, and the whole plant is a complete and compact unit. It so happens that every bit of the aggregate on this job is handled by machinery—dug with a shovel from a hillside in the Livermore Valley 30 miles away; loaded directly into railroad cars; from the cars into trucks at the San Francisco terminal; and dumped from the trucks into the storage bins on the job, over a runway from an upper street level. The mixer is so placed that it pours directly into the aforementioned concrete dump-cars.

Getting "Workable" Concrete

The mixer house itself is the starting point for the tests which form the basis of several months' accumulation of data on every foot of concrete that goes into the job. Experiments

you've got to turn out the best concrete possible with whatever materials are available at the lowest possible price. Formulas worked out at Sunset Tunnel have been developed both from a theoretical and a practical viewpoint, and we *know* they'll produce real concrete.

"Water and cement and sand in concrete determine its strength, and the grading of the aggregates determines the workability of the mix. Our tests here are supplemented with further experiments at the city's laboratory under Dr. Cook. This laboratory is very completely equipped for testing. It has a strength-testing machine that will exert a maximum of 150,000 pounds, and other apparatus for testing reinforced concrete and its several ingredients.

"The aggregates we use consist of about



AT THE END OF THE FULL HEADING, SUNSET TUNNEL

This shows a Marion-20 steam-shovel with shortened boom and boiler removed and back end cut down, sitting into the 25-foot tunnel and mucking out the heading. This shovel loads directly into dump-cars hauled by Plymouth gasoline locomotives

have been chiefly concerned with the water and cement ratio and the proper grading of aggregates to produce concrete of standard strength and weight, with the highest possible quality of "workability," or ease and smoothness of flow.

"Primarily, we're making concrete on this job," says Resident Engineer Bartell. "The tests are for records, of course, and when the job is finished, we will have a complete story of concrete. But workable concrete of the required strength is what we're after.

"You can find text book formulas that tell you how to make concrete, but most of them have the academic viewpoint—they don't always take the contractor's commercial viewpoint into consideration, nor the fact that

2¼ parts fines—sand—to 4½ parts of coarse materials. The bunkers contain coarse aggregates in two sizes, ¼-inch to ¾-inch, and ¾-inch to 1½-inch.

"For testing the weight, we keep a wooden box of 1-cubic-foot capacity at the mixer, and scales for weighing samples. For strength tests, we take these samples to the laboratory and put them under pressure. Our standard strength requires that the samples shall stand from 2,200 to 2,400 pounds to the square inch in 28 days, keeping close to 2,400 pounds.

"The water-cement ratio is fixed at 55 pounds to the sack of cement, including the moisture contained in the aggregates, which is determined from time to time by tests at the laboratory. The water added to the mix is



TIMBER SYSTEM IN THE SUNSET TUNNEL

This illustration shows a portion with extra timbering provided to support a section of soft earth. Throughout this job, 12- x 12-inch timbers are used. The tracks running into the tunnel are seen at the left and right. At the left the footing for the invert has already been poured, and on the right the reinforcement is waiting for it

accurately measured by means of a glass gage on top of the mixer tank.

"An experienced concrete man can tell by looking at a batch whether it is of uniform quality or not, once the tests have determined the best mix. If it *looks* all right and *works* all right, then it *is* right, and no change in formula is necessary.

"But the workability of your concrete can best be regulated by grading the amount of coarse aggregate in the mix, according to the way it acts."

Formulas for the Mix

For the mix used in Sunset Tunnel, one sack of cement to $2\frac{1}{4}$ cubic feet of sand yields $2\frac{1}{4}$ cubic feet of mortar. This weighs 140 pounds per cubic foot and tests to 3,800 pounds in 28 days. Combine this with $4\frac{1}{2}$ cubic feet of aggregate, and it yields 5 cubic feet of concrete of an average weight of $153\frac{1}{2}$ pounds, testing to the standard strength of 2,200 to 2,400 pounds per square inch in 28 days.

The weight of the concrete is usually somewhere between $153\frac{1}{2}$ and 155 pounds. It is never allowed to drop below this range under ordinary conditions. In pouring a section containing extra reinforcements, it was found necessary to reduce the size of the coarsest material because it would not slip down be-

STANDARD MIX USED IN SUNSET TUNNEL

Cement	Cu. Ft. Sand	Cu. Ft. Aggregate
1 sack	$2\frac{1}{4}$	$4\frac{1}{2}$

yields:

$2\frac{1}{4}$ cu. ft. mortar

Weight: 140 pounds per cu. ft.

Strength: 3,800 pounds in 28 days

yields:

5 cu. ft. concrete

Weight: $153\frac{1}{2}$ to 155 pounds per cu. ft.

Strength: 2,200 to 2,400 pounds in 28 days

tween the closely packed reinforcing steel, but would permit the mortar and lighter material to filter through. This was quickly discovered (in pouring the footings for the invert) and the coarsest size of aggregate was reduced. In this single case, the weight dropped to $151\frac{1}{2}$, but it stayed there for only two batches, and then was immediately brought up again by adding coarse material when the extra reinforcement was covered.

More About Personnel

The efficiency with which any construction job is handled depends largely on choice of personnel. City engineers and the contractor's crew on the Sunset job fit together like cogs in a machine. The Resident Engineer's staff of six men was chosen personally by Mr. Bartell, and all have had wide experience on tunnel work and similar concrete jobs.

CONCRETE LABORATORY ON THE SUNSET TUNNEL JOB

Weighing a cubic foot of concrete as part of the elaborate system of concrete tests in the Sunset Tunnel. J. L. Saunders, concrete inspector, is shown in the picture. Samples are scooped out of the mixer into the wooden box at the foot of the scales.

Other samples in cylindrical pasteboard boxes are taken to the city's chemical laboratory for strength tests

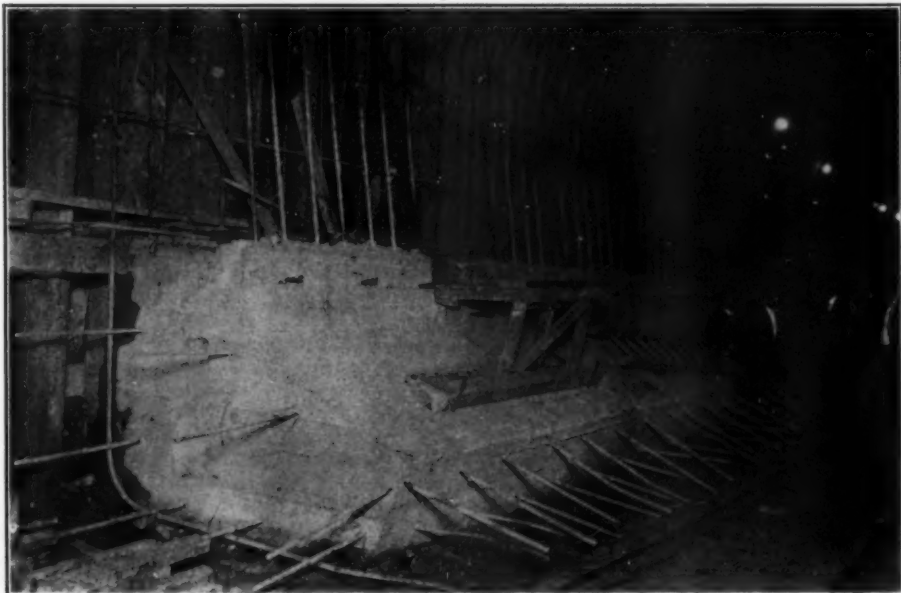


There is no precedence among them. Each man has his particular task, and it is Mr. Bartell's plan to train each one so that he can handle any part of the work of another member of the staff should it be necessary. E. F. Mulheim is the Chief Assistant Engineer; J. L. Saunders, Concrete Inspector; F. D. Brown, Office Engineer, and J. C. Foß and Tom Mulaney are on tunnel alignment.

Safety, Ventilating and Lighting

As a safety measure, the tracks leading from the tunnel to the trestle and dumping bins are broken at crucial points with derailing switches. This precautionary measure insures against runaway cars and trains, and a stringent set of rules guides the workers in every move they make.

As an additional precaution, the trestle lead-



FOOTING FOR INVERT AND WALLS

This footing is 2 feet deep and 6 feet 10 1/4 inches wide along the base. The spacing of the reinforcing steel, both vertical and longitudinal, as well as the timber system in the walls at the spring, is shown in this illustration

ing to the muck hoppers is built on a 2 per cent uphill grade, so that if a car ran away in the tunnel and reached the trestle, the grade would stop it before it reached the end.

The tunnel is designed to be self-ventilating. There is always a wind blowing in from the beach, and the length of the bore (less than a mile) makes artificial ventilation unnecessary.

Electric lights at frequent intervals on the tunnel walls provide lighting. The wiring system is contained in $\frac{3}{4}$ -inch galvanized wrought iron pipe conduits in the sides, reached through deep niches.

Cost and Quantities

The estimated costs and quantities have been listed by the City Engineer's staff.

ESTIMATED QUANTITIES	
Earth section	800 feet
Rock section	3,432 feet
Excavation	121,722 cubic yards
Concrete	24,630 cubic yards
Reinforcing steel	1,210,732 pounds
ESTIMATED COSTS	
Construction	\$1,401,704.60

Engineering, collections, etc.....	157,205.41
Lands and easements.....	93,073.00
Total estimated cost.....	\$1,651,983.01

The Youdall contract does not include laying the tracks. The city will run its Municipal Railway through the tunnel, and city crews will lay the tracks over ballast laid on top of the invert.

When the new route is open, it will take just 39 minutes to get from the Beach to the Ferry Building, cutting off 12 minutes from the time required for the present routing and relieving much congestion on lines now tapping the Sunset District.

Although it is considerably smaller, Sunset Tunnel is similar in many ways to the famous Twin Peaks tunnel which runs parallel to it in an adjoining district. This tunnel, finished in 1915, is 12,000 feet long, 25 feet wide and 25 feet high, with 15 feet of clearance above the invert, and designed also for two-way street-car traffic. This tunnel cost \$4,250,000.

An Aid to Earthwork Computation

By G. I. GIBBS

Civil Engineer, Asheville, N. C.

THE accompanying table will be found very useful by those having earthwork to figure. It was calculated from the following formulas, in which V represents the volume in cubic yards, b_1 , b_2 the areas of the bases in square feet, and L the length of the section in feet:

$$\text{For Prismoids } V = \frac{\frac{b_1 + b_2}{2} \times L}{27}$$

$$\text{For Pyramids } V = \frac{\frac{b}{3} \times L}{27}$$

For prismoids (ordinary sections with a cut, or fill, area at each end) simply add together the two areas (in square feet) and multiply their sum by the upper figure corresponding to the length of the section.

For pyramids (sections at the extremities of a cut, or a fill, which run to a zero section at one end) multiply the area of the one end (in square feet) by the lower figure corresponding to the length of the section.

The result in each case will be the volume in cubic yards.

Example

In figuring earthwork on a road-bed, the following end areas are obtained. Required the volume:

Station	End Area Sq. Ft.
10 + 13.....	0.0
10 + 50.....	25.7
11 + 00.....	150.3
11 + 50.....	47.9
11 + 74.....	19.3
11 + 99.....	0.0

The first section is a pyramid, as it has only one base and comes to a point at the other end. The area of this base is 25.7 square feet. The length of this section is 37 feet. Opposite 3 in the left-hand column of the table (Tens) and under 7 in the top row (Units), the lower figure is .4568:

$$25.7 \times .4568 = 11.74 \text{ cubic yards}$$

The second, third and fourth sections are prismoids, having a base at each end. For the second section, $L = 50$ feet and $b_1 + b_2 = 25.7 + 150.3 = 176.0$ square feet. Opposite 5 and under 0 in the table (50), the upper figure is .9259:

$$176.0 \times .9259 = 162.96 \text{ cubic yards}$$

Similarly for the third and fourth sections:

$$198.2 \times .9259 = 183.51 \text{ cubic yards}$$

$$67.2 \times .4444 = 29.86 \text{ cubic yards}$$

The last section is again a pyramid, which takes the lower figure:

$$19.3 \times .3086 = 5.96 \text{ cubic yards}$$

The sum of these results, 394.03 cubic yards, is the volume as figured by the average end

area method.

The table gives results correct to the nearest one-hundredth of a cubic yard for small areas and proportionately correct for larger ones, and will be found especially valuable when used in conjunction with a calculating machine:

TABLE OF CONSTANTS FOR EARTHWORK CALCULATIONS

		(Average End Area Method)									
For Prismoids.....		$b_1 + b_2$ (in sq. ft.) \times Upper Figure = V (in cu. yds)									
For Pyramids.....		b (in sq. ft.) \times Lower Figure = V (in cu. yds.)									
Length of Sec	U n i t s	0	1	2	3	4	5	6	7	8	9
Tens											
0		.0000	.0185	.0370	.0556	.0741	.0926	.1111	.1296	.1481	.1667
		.0000	.0123	.0247	.0370	.0494	.0617	.0741	.0864	.0988	.1111
1		.1852	.2037	.2222	.2407	.2593	.2778	.2963	.3148	.3333	.3519
		.1235	.1358	.1481	.1605	.1728	.1852	.1975	.2099	.2222	.2346
2		.3704	.3889	.4074	.4259	.4444	.4630	.4815	.5000	.5185	.5370
		.2409	.2593	.2716	.2840	.2963	.3086	.3210	.3333	.3457	.3580
3		.5556	.5741	.5926	.6111	.6296	.6481	.6667	.6852	.7037	.7222
		.3704	.3827	.3951	.4074	.4198	.4321	.4444	.4568	.4691	.4815
4		.7407	.7593	.7778	.7963	.8148	.8333	.8519	.8704	.8889	.9074
		.4938	.5062	.5185	.5309	.5432	.5556	.5679	.5802	.5926	.6049
5		.9259	.9444	.9630	.9815	1.0000	1.0185	1.0370	1.0556	1.0741	1.0926
		.6173	.6296	.6420	.6543	.6667	.6790	.6914	.7037	.7160	.7284
6		1.1111	1.1296	1.1481	1.1667	1.1852	1.2037	1.2222	1.2407	1.2593	1.2778
		.7407	.7531	.7654	.7778	.7901	.8025	.8148	.8272	.8395	.8519
7		1.2963	1.3148	1.3333	1.3519	1.3704	1.3889	1.4074	1.4259	1.4444	1.4630
		.8642	.8765	.8889	.9012	.9136	.9259	.9383	.9506	.9630	.9753
8		1.4815	1.5000	1.5185	1.5370	1.5556	1.5741	1.5926	1.6111	1.6296	1.6481
		.9877	1.0000	1.0123	1.0247	1.0370	1.0494	1.0617	1.0741	1.0864	1.0988
9		1.6667	1.6852	1.7037	1.7222	1.7407	1.7593	1.7778	1.7963	1.8148	1.8333
		1.1111	1.1235	1.1358	1.1481	1.1605	1.1728	1.1852	1.1975	1.2099	1.2222
10		1.8519	1.8704	1.8889	1.9074	1.9259	1.9444	1.9630	1.9815	2.0000	2.0185
		1.2346	1.2469	1.2593	1.2716	1.2840	1.2963	1.3086	1.3210	1.3333	1.3457

Largest Bascule Lift Bridge in East to Carry Manhattan Trains

Elaborate Electric Protective System Insures Safe Operation

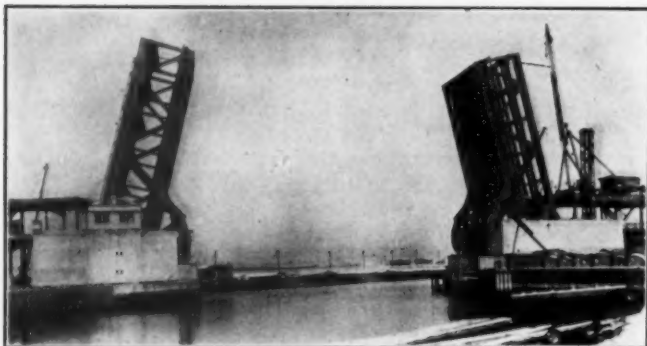
ROOSEVELT Avenue Bridge, New York City, the largest trunnion bascule lift bridge east of Chicago, and probably the largest of its exact type in the world, will soon carry Manhattan subway trains across Flushing River to Flushing, Long Island. The bridge consists of two movable leaves which turn upon huge trunnions and open like the blades of a jack-knife, to permit the passage of ships. Each leaf is 152 feet long and weighs close to 4,000,000 pounds. So delicately is this great weight counterbalanced, however, that four 80-horsepower electric motors can open or close the bridge in 45 seconds against the pressure of a 25-mile-an-hour wind. Westinghouse motors provide the motive power. The clear height of the bridge is 25.6 feet above mean high water, which is sufficient to permit the passage of ordinary tug-boat traffic without opening the bridge.

An unusual feature of this bridge is that it

is double-decked. The upper level will carry three rapid-transit railroad tracks, and the lower will provide a very much needed vehicular thoroughfare for this locality.

Electric Safety System

Special attention has been given to insuring complete safety in the operation of this bridge, and the engineers of the Department of Plant and Structures of the City of New York, assisted by the engineers of the Westinghouse company, have devised a system that is regarded as completely adequate. When a ship which is unable to go under the bridge wishes to pass up the river it signals the bridge operator. The operator is unable to move the bridge, however, for all motive power circuits on the bridge are normally dead. His first step is to signal to the towerman controlling the operation of the trains, that he wishes to open the bridge. The towerman then sets the sig-



**THE
ROOSEVELT AVENUE
BRIDGE, NEW YORK,
OPEN FOR RIVER
TRAFFIC**

Note double-deck
construction for through
rapid transit railroad
tracks above, and
vehicular roadway below

nals against the trains (which, however, he cannot do until the bridge and its approaches are clear of trains), and this operation automatically energizes the bridge's motive power circuits. The bridge operator is now able to start successively the various motors, which perform the following functions:

1. Two huge steel bolts, weighing 400 pounds each, which lock the two leaves of the bridge together while in closed position, are withdrawn.

2. After the bolts are fully withdrawn the tail lock struts which brace the bridge leaves at their shore ends are withdrawn.

3. The bridge leaves are lifted and open the way for the vessel.

After the passage of the vessel, the bridge operator closes the bridge and locks it, and not until everything is in perfect order, can the towerman set "clear" signals for the trains.

This system is so arranged that each step in the process of opening or closing the bridge must be taken in exactly the right order, and no step can be taken until the previous one has

been properly completed. A signal light on the operator's desk at the controllers indicates the proper performance of each step. If anything should jam or power fail, everything becomes locked in position so that no part of the mechanism can "run wild." The leaves do not open or close completely in a single movement, but stop just before they reach the end of their travel, the last few inches being taken at a very low speed. This prevents damaging the bridge structure by slamming it against the stop. Duplicate motive-power equipment is provided to insure continuous operation in case any piece of apparatus goes out of commission for some reason.

The total cost of the bridge and its approaches will be \$2,700,000. The bridge is being constructed under supervision of the Department of Plant and Structures, Albert Goldman, Commissioner, Edward A. Byrne, Chief Engineer. The Arthur McMullen Company is the general contractor, and the McClintic-Marshall Company have fabricated and erected the steel superstructure.

Business Notes

Joe Helm in New York

THE Standard Oil Company of New Jersey, 26 Broadway, New York, has announced the appointment of Joseph S. Helm, Manager of the Asphalt Department of the Standard Oil Company of Louisiana and located at New Orleans, as General Manager of Asphalt Sales at home and abroad for the Standard Oil Company of New Jersey. C. G. Sheffield, until recently in charge of the Asphalt Department, Standard Oil Company of New Jersey, has been placed in charge of sales in the Lubricating Department. Under Mr. Helm, all the asphalt sales work of the New Jersey Company will be centered at 26 Broadway, New York. With his transfer to the Lubricating Oil Department as Manager of Sales, Mr. Sheffield retired as President of the Asphalt Association.

Le Roi Takes Over Beaver Business

THE LeRoi Company, Milwaukee, Wis., has taken over the business formerly conducted by the Beaver Manufacturing Company, also of Milwaukee, Wis., makers of Beaver heavy-duty gasoline engines. With the Beaver line of gasoline engines, the LeRoi Company will now manufacture gasoline engines ranging in horsepower from the small 3 to the big 160. The heavy-duty Beaver engines have been widely known for their "Brute" strength and have been serving the field for twenty-five years.

Beaver engines are solely intended for extremely heavy duty and have a horsepower range from 40 to 160. They are made in four and six-cylinder sizes with a bore and stroke range from $4\frac{1}{4} \times 6$ to $6\frac{1}{2} \times 7$.

Does the State Desire Contractors to Bid Without Profit?

By LESLIE R. AMES

State Highway Engineer, North Carolina State Highway Commission

IF this same question were put to any man as an individual by a merchant, baker, or candlestick maker, the reply would unanimously be "No." The laws which govern the world's progress are fundamental and true because they govern to-day as they have always governed from the beginning of time. These are not man-made laws, and for this reason they have never been altered or changed and they will last until time is no more. The first law of this world of ours was that of creation and the second law that of supply and demand. Each and every state road building organization must of necessity rely on these two basic and fundamental laws and nothing can be done to change or alter them.

The state cannot force the contractor to bid on its work, nor can the state force a contractor to bid without a profit. The advertisements and proposals are sent out to contractors, informing them that there is to be a public letting on a certain date under well-defined plans and specifications, and it then rests with the contractor as to whether or not he wishes to bid and what the amounts of his unit bids will be of any specific contract.

We have awarded contracts in the state of North Carolina totaling approximately \$125,000,000, and there have been 41 actual defaults. This does not mean that 41 contractors have been defaulted, however. Considering the large

program that has been carried on in the comparatively short period of six years, we feel that the percentage of defaults has been small.

We have gone further than this and have analyzed the reason for these defaults. Only

two of the contractors defaulted because of under-bidding their jobs. The other failures were due primarily to lack of experience in the contracting business. They had practically no equipment, which means that they had no funds. Six of the failures were directly traceable to neglect of business. Back of all this stands the bonding company, for the reason that if they had conducted the proper investigation before writing the bid bond, the majority of these defaults would not have occurred.

In the state of North Carolina we do our utmost to so word the specifications that the minds of the Commission and the contractor may be in mutual understanding. Unless the specifications are explicit and in detail there will be various interpretations placed on them by the contracting parties. It is also our desire in North Carolina to make the contractor feel that it is his right

and privilege to appeal from the decision of any subordinate in case he thinks he is being required to do work outside the specifications.

After issuing the invitations for bids, the specifications, the plans and the form of contract, it is up to the contractor to consider

The Obligation of a State Highway Commission

1. *The adoption of a definitely laid out system of state highways.*
2. *The location of roads which are most necessary to the public weal.*
3. *An engineering study of each location taking into consideration the various factors entering into alternate locations.*
4. *An intensive study and survey of the availability and quantity of local materials.*
5. *An estimate of the present traffic intensity, kind and weight, and also of the expectancy of traffic ten to twenty years hence.*
6. *The drawing of proper specifications and plans, agreeing and tying in closely with each other so that the final product, the completed road, will itself or by progressive steps be adaptable to the traffic requirements.*
7. *Methods of advertising and presenting these plans and specifications to the contracting fraternity in such a way that the state highway commission will receive bids properly secured by a reputable bonding company to protect the taxpayer.*
8. *The proper award and execution of the contract.*
9. *The proper administrative and engineering organization to carry out the various details in connection with the steps outlined above.*

whether he will bid under such conditions. Should the state go further? This question may readily be answered "Yes."

The bids having been received and checked and tabulated, and it is found that a certain contractor has submitted the lowest bid, the question arises as to whether or not the low bidder is responsible.

Responsibility

The North Carolina State Highway Commission, before awarding a contract, requires the low bidder to fill out a standard experience questionnaire and financial statement, which questionnaire and statement is carefully investigated before the actual award is made. In awarding the contract, we do not hesitate to throw out the lowest bidder, provided, in our opinion, he is not responsible and is incapable of carrying out his contract. The contractor in signing the contract has bound himself to complete the work according to the plans and specifications. If he has bid without a profit, there are always complications encountered by the contractor continually harassing the state highway officials with the idea of producing inferior work which does not meet the specifications.

While there are only three parties actually signing the contract, there are in reality five parties involved, namely, the state highway

commission, the contractor, the bonding company, the materialman and the taxpayer. If the contractor has bid without a profit, and particularly if the contractor is an irresponsible one, the five parties involved in the contract are soon surrounded by difficulties, because of the fact that the contractor is unable from his profit to pay the materialman, and because he is continually attempting to construct the work in such a way that makes it impossible for him to carry out the specifications.

One of the greatest difficulties with which the state highway official has to contend is the fact that the contractor before signing the contract is not entirely familiar with the specifications. I believe that a great deal of missionary work can be done by contractors' organizations in drilling into their membership the fact that before bidding on work of any nature, it is absolutely necessary to study and to know in detail the specifications under which the work is to be carried out.

The State Highway Commission of North Carolina revises its specifications yearly. Considerable time and expense could be saved both by the contractor and the State Highway Commission if the contractor would familiarize himself with the various details of the specifications.

ACKNOWLEDGMENT.—From a paper presented before the Eighth Annual Convention, Associated General Contractors at Asheville, N. C.



AN ILLUSTRATION OF WHAT A DUMP-TRUCK CAN DO AND STILL COME UP SMILING

This Gotfredson Wood-equipped dump-truck is "in bad." It got that way because a bank of dirt on the side of the excavation gave way, which almost completely upset the truck. When the truck was pulled out of the hole, inspection revealed nothing wrong, and it was back on the job within an hour. It was necessary for it to get back on the job with its team mates as the fleet had a big job to do on the five-million-dollar addition to the plant of the Ford Motor Company of Canada. Forty thousand cubic yards or approximately eight thousand truck loads of dirt were removed.

A New Way to Set Poles

Florida Company Combines the Work of Pole Digging and Pole Setting in One Operation

FOR a half century the orthodox method of building telegraph and telephone lines has been to dig holes and then plant poles.

are still used. Explosives are used chiefly in soft, plastic soils in swamps where caissons would ordinarily be used and in places where poles must be set deep under water.

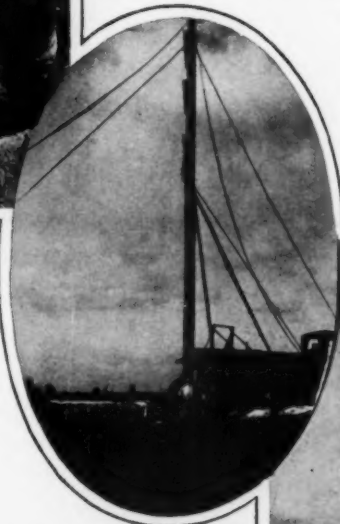
The method is simple. A hollow drill pipe, usually 1½ inches in diameter, is driven vertically to the required depth, the soil being forced out at the bottom with a ram. The explosive charge, primed with an electric blasting cap, is lowered through the pipe to the bottom, whereupon the pipe is removed and the charge is ready for shooting. Next, the pole is raised to vertical position with its butt on the ground directly over the charge. Small poles are supported in place with pike poles—large poles with four-way rigging. Then the charge is set off. The blast creates a gas pocket and the pole drops into it as the gases escape around its sides. Sometimes there is a lapse of a few seconds before the pole drops. The surface crust, unbroken, remains in place until the



Three stages of the Florida method: Above—loading the hole; at right—placing pole above charge; below—the blast

Now, a revolutionary method using explosives has been developed. At least this is true in the swampy sections of Florida where the use of hand-shovels and digging machines is impracticable. Dynamite does the digging and gravitation does the setting, both jobs being done simultaneously. The Southern Bell Telephone Company was the first to erect a line of small poles in western Florida by this method. In 1925 the Phoenix Utilities Company tried setting a line of 55-foot poles at Punta Gorda, also with success, and since then the technique of pole setting with explosives has been improved in many respects.

Of course, in soils where there is no likelihood of the ground caving in before the poles are set, hand- and machine-digging methods



gas pressure recedes to some extent, and then gives way to the pole above it.

Tamping is rarely necessary in muck and loam swamps. Natural ground and water pres-

sure force the soil firmly around the pole. In fact the crew must often work fast in aligning a pole before it becomes too firmly imbedded. Under other conditions some tamping may be necessary.

Du Pont 40 per cent straight dynamite is the explosive used, the charges varying in amount with the soil, pole depth and other conditions. The following table is a resumé of opinions from superintendents and foremen who have had experience with such work:

No. of Sticks	Type of Soil	Depth of Hole (feet)
2 1/4	Swamp, muck underlying.....	6 to 7
3	Swamp, muck and rock underlying...	6 to 7
3	Sand and water.....	7 to 7 1/2
4 to 5	Ojus rock (Native South Florida)...	6 to 7

Poles as long as 110 feet have been set successfully by this method in holes from 14 to 16 feet deep. Many pole lines have been so constructed throughout Florida and doubtless in the South many more lines will be built as other companies and contractors learn of the method.

Two Construction Accidents in New York City

Derrick Crash and Undermined Foundation Cause Several Deaths and Injuries

ON January 7 a steel derrick which was being erected in the excavation for the new 26-story Equitable Building at 20 Broad Street, collapsed, killing four men and injuring six others. The foundation work was described in *CONTRACTORS' & ENGINEERS' MONTHLY*, November, 1926, pages 55-57. The mast and boom fell with a grinding roar which shook the financial district of New York, breaking windows and rattling desks. Two of the men killed were at work on top of the mast placing guy wires for the derrick when the collapse came. They dropped with the tall steel mast and were buried beneath the wreck-

age which the steel made in the 60-foot-deep foundations. The other men killed were at work on the wooden platform supporting the derrick or were nearby. Two were directly in the path of the derrick as it fell and they were crushed by the heavy steel.

Inspectors of the Bureau of Buildings of the Borough of Manhattan investigated the accident, but were unable to obtain a reliable story of exactly what happened. Some witnesses stated that there was a sudden grinding noise immediately followed by the falling of the whole derrick as one piece. Other witnesses said that the wooden platform collapsed and



"International Newsreels" Photo.

STEEL ERECTION DERRICK CRASHES IN BROAD STREET, NEW YORK, STRUCTURE
Panic reigned in Wall Street when it was shaken by this steel derrick which crashed with its 2-ton load of steel to the bottom of the new 35-story building under construction at Broad Street and Exchange Place



Wide World Photo

SCENE OF ONE OF NEW YORK'S LATEST CONSTRUCTION ACCIDENTS AT 116th ST. AND LEXINGTON AVENUE

Falling plaster and the sound of cracking timbers warned the twenty occupants of this building of the pending disaster so that they reached safety before it collapsed and fell into the excavation. The collapse was caused by insufficient underpinning to protect structure from excavation in adjacent lot

that the derrick plunged through it, toppling over afterwards.

The second accident fortunately caused no loss of life. A four-story brick building at 131 East 116th Street, New York, collapsed on the same day as the Broad Street accident and toppled into an excavation which was being made for a large apartment house next door. Workmen on the new structure saw signs of the collapse in time to warn all tenants to leave the building so that no one was hurt. Adjacent houses were examined by the Building Department after the accident and all tenants were ordered out as the buildings were reported unfit

for occupancy and might collapse at any moment. This warning was the direct means of preventing any fatalities.

The foundation of the four-story building had been undermined by the excavation for the new apartment house. At eleven o'clock in the morning, several tenants heard the building creak and groan. Early in the afternoon, it was obvious that the building was falling and workmen warned the occupants of the offices and apartments. Everyone was clear of the structure before it collapsed, but the tenants lost their furniture and other belongings.

Readers of CONTRACTORS' & ENGINEERS' MONTHLY should always consult the "Where to Purchase Section," pages 3 to 44, when needing further information for prospective bidding

A. G. C. Issues Optimistic Construction Report

Continued Need of New Housing and Outlet for Bank Deposits Will Keep Market Active

THE volume of construction operations in the United States promises to equal the record-breaking activities of last year. This is the opinion of more than two thousand of the leading contractors of the country, as expressed in a statement issued at the eighth annual meeting of the Associated General Contractors of America, held at Asheville, N. C. The prediction is based upon observations made in virtually every state of the Union.

"We are convinced," the statement declares, "that a large number of economic and sociological influences are currently at work to create a steady demand for conservatively financed, well-designed and soundly built structures of various types. The annual increase in population requires a large amount of construction of all kinds.

"There is an increasing tendency of population to drift from farms to cities, as well as an increased desire for speed, safety and service in transportation and communication.

"While some cities may not need immediate additional hotel, office, or luxuriant apartment floor space, all types of construction activities are feeling the effect of the trend toward 'modernization.' Obsolescence of office and factory buildings, theaters and schools is constantly making a call for new structures, as is also the necessity for widening the main arteries of traffic in metropolitan areas.

"Railroads are undertaking elimination of grade crossings, elevation of tracks and new mileage to meet newly developing conditions. The vast volume of automobile traffic is demanding not only thousands of miles of paved highways, but that roads be widened, and operations virtually identical with the construction of new roads. A large number of garages are being required to offset 'no parking' ordinances in cities, and toll-bridges are springing up all over the country.

"Public utilities corporations are being forced to meet demands for increased service by making large additions to their plants. Subways for city transit and tunnels for lighter railway grades are now being constructed. Projects financed by federal, state, county and municipal governments will require a large volume of construction materials and labor; and river and harbor work, irrigation and hydro-electric projects are under way.

"Creation of new industries, the construction of branch houses and enlargement of old factories will help hold demand in that field of construction at a high level.

"Revision and expansion of educational methods are requiring new community, vocational and high school buildings. America is on a higher plane of demand for satisfaction of what may be termed its 'personal desires,' which are manifested in the erection of palatial movie houses, country clubs and apartment houses, libraries, and water-works, and sewer systems which provide the latest improvements.

"Only three years ago the report of the Regional Plan of New York and Its Environs stated that 663,000 persons in the nation's metropolis were 'poorly housed.' It is conservative to assume that similar conditions existed at that time in other large centers of population. The record-breaking activities of the past three years have not held sufficient volume to correct these conditions for moderate housing, and at the same time meet the demands of 'modernization' in old homes.

"Banks and mortgage-bond houses which handle the financing of construction operations should not depend upon the volume of building permits in the cities for their information in drawing conclusions concerning the trend of future construction. These building-permit statistics do not form a true barometer of the activities of the construction industries, for they fail to include the vast volume of construction of public works, highways, railroad improvement, and much public utility work. There is also a time lag between issuance of permits and the financing and completion of buildings.

"The increased volume of saving and insurance funds which seek investment, the fact that there is no reason for expecting an increase in the wages of construction labor, the tendency toward lower interest rates, the general prosperity of the country, the large volume of farm and mine production, the increasing demand for electricity, gas, water, and transportation facilities, all tend to confirm the general view that 1927 will be an active construction year.

"Comparison of post-war costs with pre-war prices forces the conclusion that the American construction program is on a normal basis."

New Heltzel Products

AMONG the new products which the Heltzel Steel Form & Iron Company, Warren, Ohio, has developed is its 105-ton trailer bin, as well as others of 35- to 55-ton capacities, equipped with rubber-tired wheels and automatic bulk batchers. The new Heltzel longitudinal joint-filling machine, which heats bituminous material and deposits it within the longitudinal joint as the material is being heated, is another new piece of equipment. This joint-filling machine is equipped

with a sanding apparatus arranged to mix the sand with the heated asphalt.

Another new product is a new type of steel curb-form embodying the use of a steel yoke, which makes the curb-form self-supporting without the use of stakes or division plates. A new type of steel manhole-form for sewer work and a specially designed steel form for widening of old concrete or bituminous-surface roads, are also announced.

O-OX-K-L-G-TX-TXA-TXO

Here is, indeed, the code to better power.

The letters above designate the eight Hercules models, each of them embracing the [1] simplicity [2] compactness [3] ruggedness [4] agility [5] uniformity [6] ease of operation [7] constancy of power and [8] minimum of attention that

proper design, and
precise manufacture, from
best available materials assure.



And here follows the code to the sizes of these superior engines:

O-OX-K-L-G-TX-TXA-TXO

4x5" 4x5" 4¼x5¾ 4½x5¾ 4¾x5¾ 5½x7 6x7 6¾x7

Which, under still more definite translation produce these maximum horsepower:

O-OX-K-L-G-TX-TXA-TXO

46HP 46HP 52HP 58HP 62HP 90HP 104HP 114HP

If your power requirements are within the range of Hercules—20 H. P. to 110 H. P.—we believe the experience of our engineering department can assist you.

We do not believe this because we hope it. We believe it because we can prove it.

HERCULES MOTORS

CORPORATION

CANTON, OHIO, U. S. A.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

Application of Payments from Contractor to Materialman

A contractor erected a building for his wife. At the same time he built one for a realty company, and bought materials for both from the same dealer. The realty company gave the contractor a check payable to the materialman, but the materialman credited the payment on account of things furnished for the house on the contractor's lot and later attempted to enforce a lien against the realty company's property. Holding that this could not be done, the Oklahoma Supreme Court said in the case of *Kubatsky vs. Pittsburgh Plate Glass Company*, 249 Pacific Reporter, 412:

"The law does not contemplate that material dealers may sell to contractors promiscuously and then establish a lien for . . . particular material upon any building the contractor may be erecting."

It was decided that the material dealer, knowing the circumstances under which the check had been issued, was bound to credit it upon the account for materials furnished for the realty company's building.

Owner's Responsibility to Subcontractor

An Arkansas road district let a contract for the building of a highway. The contracting company sublet part of the work to another corporation. The district ordered cessation of the work. The subcontracting company claimed damages from the district, but the Arkansas Supreme Court decided (*Road Improvement District No. 1 vs. Mobley Construction Company*, 286 South Western Reporter, 878) that the district was not liable. Said the Court:

"There was no obligation to the Mobley Company [the subcontractor] when the construction contract was made, and such rights as it had itself arose out of the subsequent contract between itself and the Lewelling Company [the general contractor], a contract to which . . . the road improvement district was not a party.

"We conclude, therefore, that in consenting to the subletting of a portion of the work, which the Mobley Company contracted with the Lewelling Company to perform, the district assumed no contractual relation with the Mobley Company which rendered it liable to that company for any profits it might have made by the performance of its subcontract."

Contractor Entitled to Recover Despite Illegality of Contract

The parties to county road grading contract did not foresee that removal of rock or hardpan would be necessary, and therefore did not cover it in the original contract. When hardpan was encountered the county engineer orally directed the contractor to remove it and the county commissioners sanctioned this, on an understanding that the contractor would be paid extra and reasonable compensation.

Determining the rights of the contractor in the case of *Besoloff vs. Whatcom County*, 248 Pacific Reporter, 381, the Washington Supreme Court decided that, viewed as a contract, the understanding for removing the hardpan was invalid as amounting to a letting of work without competitive bids. But the court decided that the contractor was entitled to pay on the theory of extra work incident to performance of the original contract. It was held that he was "entitled to reasonable compensation for the removal of hardpan in excess of the contract price for the removal of the earth, if such removal was by direction of the county engineer and sanction of the county commissioners, though such work was not included in the original contract entered into as provided by statute."

Public Contracts Must Be Authorized at Board Meetings

An individual may bind himself by contract whether he sign at his place of business, at his home, out on a golf course, or elsewhere. But contracts made on the part of public bodies must be authorized at official meetings of which all members have notice. It is a dangerous, even though common, practice for contractors to rely upon contracts obtained through interviewing individual members of a board at separate places, without joint action of the board.

The Law considers that the taxpayers are entitled to the benefit of joint action of its officials at a meeting where they may exchange views, hear arguments of interested parties, etc.

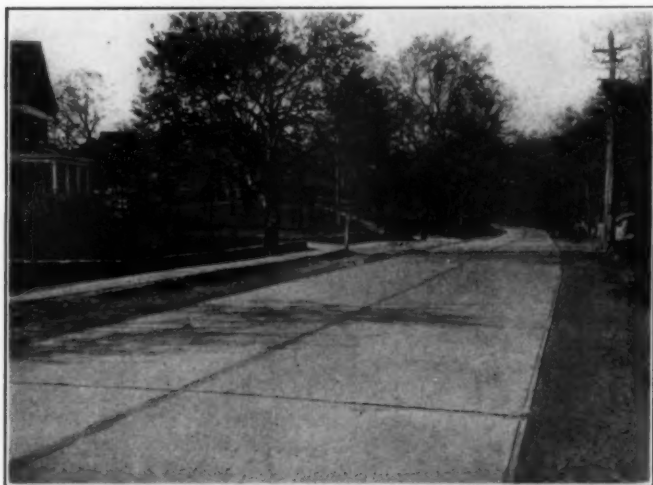
So, the Arkansas Supreme Court decided in the case of *McCrory vs. Richland Township Road Improvement District*, 284 South Western Reporter, 727, that a highway construction contract was no good where it was not secured at a meeting of the district commissioners, but through the individual action of two members who signed at different times and different places.

American Steel & Wire

Company's

WIRE FABRIC

"The Steel Backbone for Concrete"



Reinforce the Entire Concrete Slab to Insure Longer Road Life

HIGHWAY research checked by laboratory tests has definitely established the superiority of the reinforced slab.

By the same tests and surveys, Wire Fabric has proved itself the perfect slab reinforcement.

American Steel & Wire Company's Wire Fabric provides complete distribution of strong, cold drawn steel throughout the slab. This is the most



effective reinforcement against cracks and slab disintegration. No other form of steel reinforcement provides such complete protection.

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When Change in Contract Releases a Surety

The fact that a contractor's bondsman is willing to protect the owner against loss arising on account of the contractor's failure to erect a one-story building does not mean that the bondsman is willing to stand behind a modification of the contract so as to call for erection of a ten-story building. To so change the contract is to increase the risk of the surety being held liable on the bond. Therefore, it is a very reasonable rule of law which declares that a surety is released from liability if the contract as to which he is bondsman be changed without his consent in such way that the risk of his being held liable is substantially increased.

But the United States Supreme Court of Appeals, Fifth Circuit, lately decided in the case of *New Amsterdam Casualty Company vs. W. T. Taylor Construction Company*, 12 Federal Reporter, 2d Series, 972, that a highway subcontractor's surety was not released from liability because a supplemental subcontract was made for additional work in connection with the work originally provided for. The bond was so worded as to bind the surety company merely for performance of the original contract, and the company was in no way prejudiced by the agreement for the additional work. Hence, the company was not released from liability.

Unsuccessful Bidder's Objection Failed

There is a rule of law of wide force, to the effect that only one who is injured in some way can complain of irregularities. The authorities of an Oregon city may act unwisely or unfairly in awarding a contract, but that is no concern of a New Yorker whose pocketbook is in no way affected.

This principle was applied not long ago by the Supreme Court of New Jersey in the case of *Critchfield vs. Mayor and Aldermen of Jersey City*, 132 Atlantic Reporter, 321. It was decided in that case that an unsuccessful bidder for a paving contract was in no position to attack the validity of the award, if he was not a resident or taxpayer of the city and if he was not legally entitled to have his bid accepted.

And it was further held that an unsuccessful bidder has no right to contest the legality of the award of a contract because the successful bidder did not comply with certain specifications upon which the proposals were received, if the unsuccessful bidder also failed to comply with them.

Contractor Who Could Not Have Performed Cannot Complain of Dismissal

If a contractor for municipal concrete work did not have enough means to secure the necessary material and labor to perform the contract, and if he could not borrow the necessary funds, he could not complain of a repudiation of the contract by the city, held the United States Circuit Court of Appeals, Eighth Circuit, in the case of *Petersen vs. Wellsville City*, 14 Federal Reporter, 2d Series, 38.

"It is quite obvious," said the Court, "that, if a contractor who agreed to furnish labor or ma-

terials would not have been able to have performed his part of the contract, he suffers no injury or loss of profits because the other contracting party refused to proceed with the contract."

Transporting Employees to and from Work

When a contractor undertakes to carry his employees by truck or other vehicle to and from their place of work he owes them a legal duty to use reasonable care for their safe transportation, holds the Springfield, Mo., Court of Appeals, in the recent case of *Watson vs. Energy Construction Company*, 286 South Western Reporter, 715. This is true whether or not the contract of employment requires transportation. By voluntarily providing means for conveying workers to and from their place of work the employer becomes bound to use the same degree of care for their safety that he must use in furnishing them with appliances for doing their work.

Contractor's Rights as Against Erroneous Drawings

A contractor has a right to assume that drawings on which his undertaking is based are not joking when they indicate conditions materially affecting the cost of doing the work. A case in point was decided by the United States Circuit Court of Appeals, Sixth Circuit (*Pitt Construction Company vs. City of Alliance, Ohio*, 12 Federal Reporter, 2d Series, 28).

The construction company built a water-works basin for the city. Blue-prints on which the contract was based indicated that there would be an average excavation of about nine feet and a fill of about nine feet, and that there would be just about enough spoil from the excavation to make the necessary back-fill. In doing the work it was discovered that the excavation would be only about three feet deep, entailing an unanticipated expense of \$9,000 in moving dirt for the fill. The court decided that there was such fault in the blue prints as to entitle the company to recover extra expense from the city.

There was the customary clause in the contract, relative to examination of the site by the contractor, assumption of the risk of difficulties to be encountered, etc. But the court said that this did not release the city from responsibility for the deception produced by the blue-prints.

As to the measure of damages recoverable by the contractor, it was decided that the city should be charged "with the reasonable cost of constructing that extra embankment which would not have been necessary if the drawings had correctly represented the vertical location of the basin, and by crediting it with the reasonable cost of the basis excavation and earth moving which were saved to the contractor by the same mistake in the plan, as compared with the excavation and moving which it rightly estimated in reliance upon the accuracy of the plans."



What U. S. Patent
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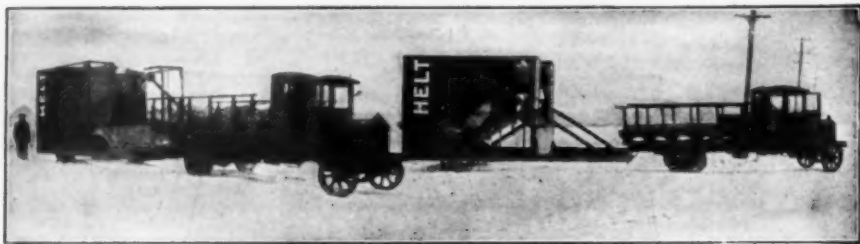
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THE NEW HELTZEL BIN BEING MOVED BY TWO TRUCKS

A Road Bin Which Carries Its Own Trailer Wheels

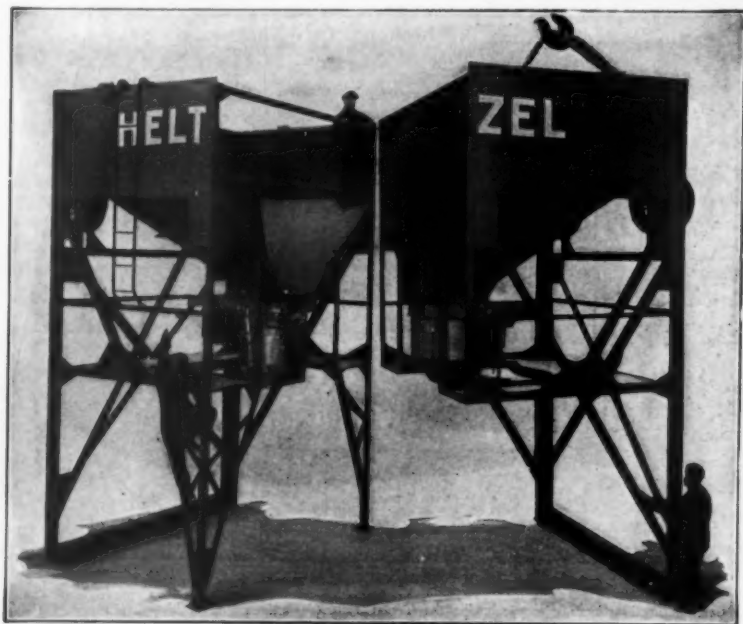
Secret of the "Mystery Bin" Revealed at the Road Show

THE construction of the Heltzel "Mystery Bin" unveiled by the Heltzel Steel Form & Iron Company, Warren, Ohio, for public inspection at the Chicago Road Show, is novel. The bin consists of 80- and 105-ton bins cut squarely in the middle on a perpendicular line, each half having its own trailer wheels. In erecting, temporary legs are fastened to one of the halves, which is stood upright with a crane. The other half is then lifted with a crane and the two halves securely fastened together with 40 bolts. The temporary legs are then removed and the outfit is ready for the first batch. The batchers remain intact and are transported with each unit.

When in trailing position each half is no larger than a standard 35-ton trailer bin and can be trailed by truck through congested street traffic

at a speed of from 10 to 20 miles per hour. The principle idea of the bin construction has been to avoid the difficult handling and erection of a large-capacity bin.

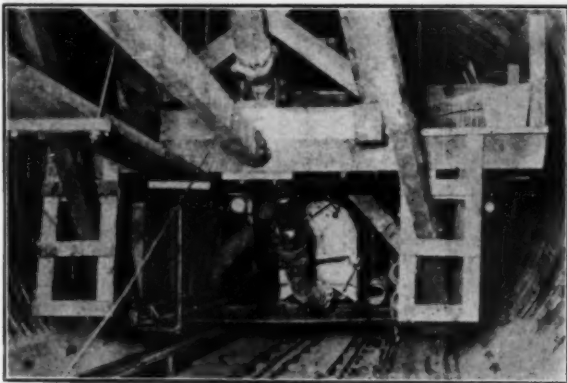
Agrabatchers are supplied with the bin for measuring materials either by weight or volume. In each case one man located on a Trilok self-cleaning steel grating platform, which completely encircles the agrabatchers 8 feet 3 inches above the ground, performs the complete operation by an easy turn of his wheel control. This is accomplished by a wheel, rack and pinions. The operator is located above the truck where he can see that all conditions are right for dumping and that the agrabatchers are all right. The weighing and measuring agrabatchers are interchangeable, using the same frame and bolt holes.



ERECTING
THE NEW
HELTZEL
PORTABLE
BIN

Ransome Pneumatic Placers

line 14 foot Water Tunnel



One of three RANSOME Horizontal Pneumatic Concrete Placers lining 14 ft. Water Tunnel at Chelan, Wash.—Grant Smith & Company, Contractors

If you have a tunnel to line—or any similar job—give us the answers to the questions below. We'll give you an idea of what Ransome Pneumatic Placers will do on your particular job, the costs and the savings, and without obligation on your part. If we recommend the use of a Ransome Pneumatic we'll guarantee its performance.

1. Is grouting to shut off water? _____
2. What is total head of water? _____
3. Estimated flow _____
4. If grouting in concreted tunnel give thickness of concrete _____; diameter of finished tunnel; distance between grout pipes _____; size of pipes _____; are pipes in place _____; nature of material outside concrete _____
5. Is grouting to solidify loose rock? _____
6. Is grouting intended to fill voids in concrete only? _____
7. Air available _____ cu. ft. _____ pressure _____
8. Send sketch giving all details possible, particularly dimensions.

Name of contractor or engineer _____

Address _____

Ransome Concrete Machinery Co.
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OTHER PNEUMATIC PLACED (McMICHAEL PATENT) JOBS

Mount Royal Tunnel, Montreal, Canada
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New York Subways (many jobs)
Southern Pacific Railroad (several tunnels)
Georgia Power Company, Telford Falls
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Rogers-Pass Tunnel, Canadian Rockies
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Sewer Tunnels, Toronto, Canada (work being done under 28 to 30 lbs. of air).

585

A Trailer Diaphragm Pumping Unit

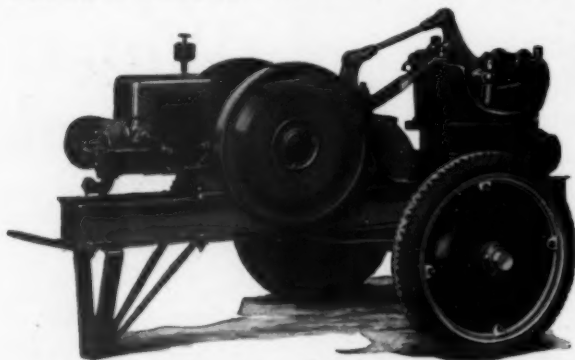
Jack Enclosed with Gears Running in Oil

A TRAILER diaphragm pumping unit equipped with a $2\frac{1}{4}$ -horsepower engine for operating a 4-inch diaphragm pump is one of the latest developments offered by the John Lauson Manufacturing Company, New Holstein, Wis. The engine is compactly built, combining simplicity and smoothness in running with even balance. The

parts subject to wear are hardened, and pistons and cylinders are ground and honed to fit, insuring good compression. The connecting rod and crankshaft bearings are inlaid and readily removable. A high tension Wico magneto and jump spark ignition are standard equipment.

The Lauson jack has an internal gear driven direct from the engine crankshaft, operated with a hardened pinion running in oil. The gear is located inside the belt pulley close to the fly-wheel, leaving the pulley free for other work. The gear connections from the engine to the jack are fully enclosed. The jack bearings are high-grade bronze. The connections to the pump are simple and well designed.

The cushion-tired trailer is strong enough to carry the outfit without danger of breakage, as particular attention has been paid to construction to make the unit strong and thoroughly practicable. These units provide all the parts to receive Gould, Deming, Barnes, or Edson pumps.



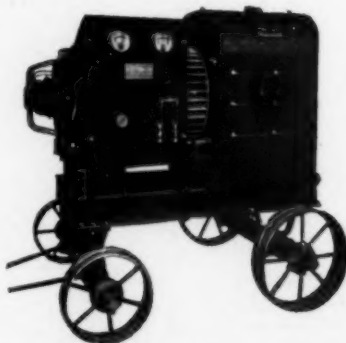
THE LAUSON TRAILER DIAPHRAGM PUMPING UNIT

A New Compact Electric Plant for Contractors

Unit Is Easily and Quickly Transported, and Is Ideal for Emergency Work

A NEW compact portable electric plant, particularly serviceable for emergency work where a good light is needed, has been placed on the market for the Cook Motor Company, Delaware, Ohio. This unit can be quickly and easily transported to any location where night work is necessary. It also makes a convenient unit for standby or emergency service.

This Powermaker electric plant is powered by a two-cylinder, fully enclosed engine which operates on either gas, gasoline or kerosene. The engine is direct-connected through a flexible coupling to a 5- or $7\frac{1}{2}$ -k.w. ball-bearing generator. The unit, consisting of engine, generator and switchboard, is mounted on a rugged, hot-riveted channel iron base and is furnished with or without wheels.

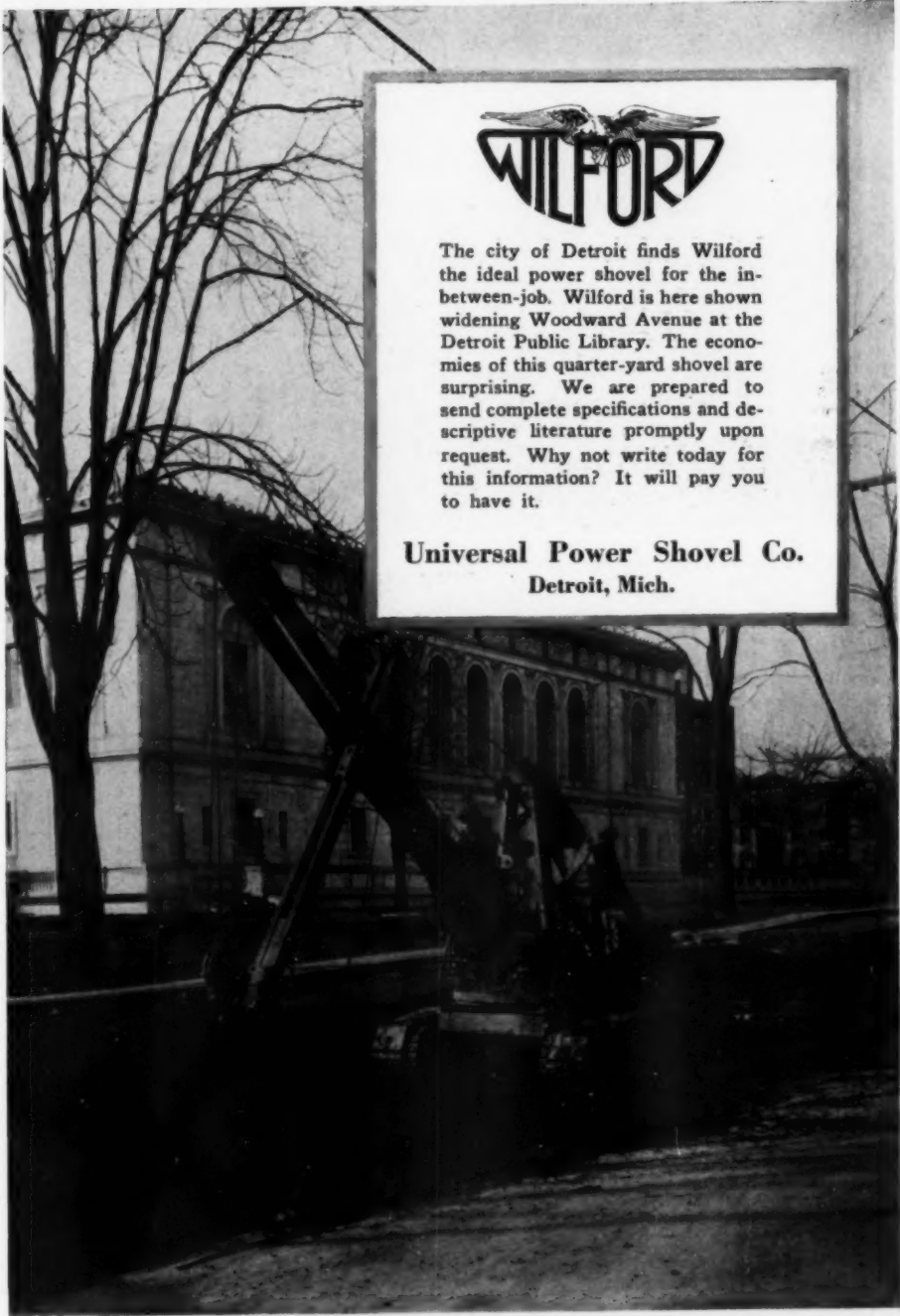



THE POWERMAKER ELECTRIC GENERATOR

Chemical Treatment for Timbering

THE Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa., will be pleased to furnish reprints of a paper on "Preservative Chemical Treatment for Mine Timbering," by A. M. Howald, Ph. D., Senior Fellow, Mellon Institute of Industrial Research, to any readers of *CONTRACTORS' & ENGINEERS' MONTHLY*, who will write for it. Dr. Howald is a specialist in wood preservation, having con-

ducted research on the subject at the Mellon Institute during the last three years, working especially on the treatment of railroad ties and mine timbering. There are many points in this paper which will be of interest to contractors and engineers. The request for reprints should be addressed to W. A. Hamor, Assistant Director, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.





The city of Detroit finds Wilford the ideal power shovel for the in-between-job. Wilford is here shown widening Woodward Avenue at the Detroit Public Library. The economies of this quarter-yard shovel are surprising. We are prepared to send complete specifications and descriptive literature promptly upon request. Why not write today for this information? It will pay you to have it.

**Universal Power Shovel Co.
Detroit, Mich.**

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A Chip Spreader for Road Work

Single Unit Capable of Keeping Whole Fleet of Trucks Busy

A CHIP spreader which is a piece of independent equipment attachable to any make of truck in one minute is now being made by the Good Roads Company, Inc., Upper Darby P. O., Philadelphia, Pa., under the name "Goroco"

from 6 to 20 feet in width. The amount of spread per square yard is controlled by the slide in the end gate of the truck. The amount can be varied from 5 to 50 pounds per square yard.

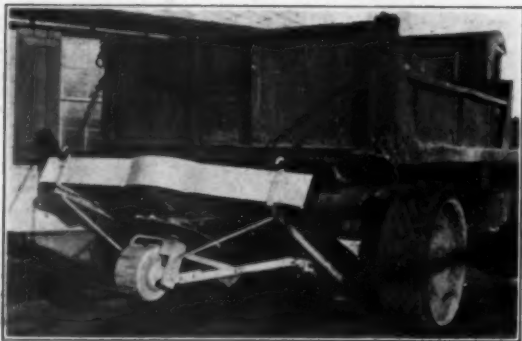
The accompanying illustrations show the con-



**AT LEFT—
GOROCO SPREADER
ATTACHED TO
TRUCK**



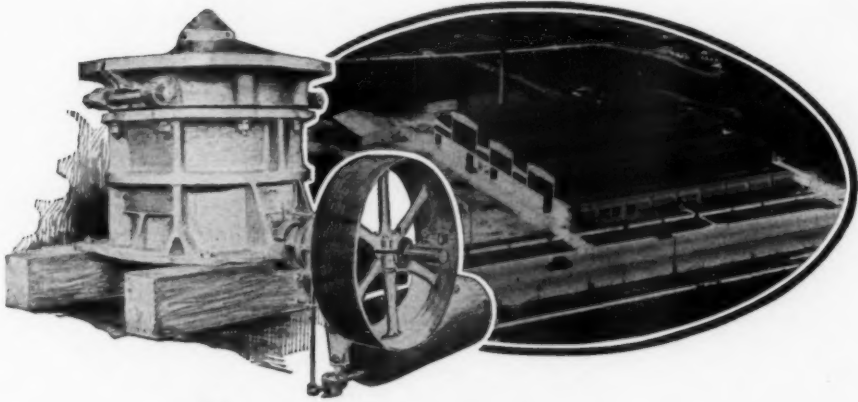
**AT RIGHT—
SPREADER READY
FOR USE, TRUCK
BODY RAISED**



**AT LEFT—
SPREADER READY
FOR TRANSPORTATION**

spreader. This spreader will handle any loose aggregate such as screenings, stone or slag chips, gravel, sand, or cinders. The width of spread is governed by the speed of the truck and varies

from 6 to 20 feet in width. The amount of spread per square yard is controlled by the slide in the end gate of the truck. The amount can be varied from 5 to 50 pounds per square yard. It is claimed that this machine will save 90 per cent of hand-labor costs.



facilities

Six acres in extent, over 50,000 sq. ft. of floor space, the latest type of fire-proof construction—there is no finer or more modern complete plant in all Milwaukee's great manufacturing district than Tel-smith's factory.

Daylight reaches every corner—every drive is guarded against accident—cleanliness and ship-shape order prevail. The buildings house a remarkable collection of heavy-duty and thoroughly modern machinery. Five huge cranes keep the machines and floor screws busy. Two railroads switch the cars that haul the finished product to the user.

This modern plant did not just happen. It is the logical result of 20 years of service. In 1908 Tel-smith floor space meas-

ured just 11,200 sq. ft. The various plant enlargements—and finally this new factory—have been forced by the steadily growing demand for Tel-smith crushers. Every new building is indisputable evidence of the permanency and popularity of the "pillar shaft" crusher

Nor is the end in sight. With the advent of the steel crusher the trend toward Tel-smith becomes even more pronounced. The modern rock man demands security. Tel-smith facilities will provide it in terms of Tel-smith Steel Crushers bearing the Tel-smith guarantee against breakage by tramp iron. May we send you particulars? Just ask for Catalog No. 171 (Tel-smith Primary Breaker) and Bulletin No. 2F21 (Tel-smith Reduction Crusher).

SMITH ENGINEERING WORKS,

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TELSMITH

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State and Contractors Organize Accident Prevention

Close Association Promotes Safety in Ohio

THE Industrial Commission of Ohio has had in operation an accident prevention division known as the Workshop and Factory Department. For a number of years this department has been engaged in this work. Last year it was thought there was room for still further development along these lines, so the Division of Safety and Hygiene was started, with T. P. Kearns as Superintendent and D. F. McMurphy as Safety Engineer. It is the purpose of this Division to survey every construction project of major proportions and fill out a report sheet. This sheet of recommendations made from the results of the Safety Engineer's survey is submitted to the contractor.

It is the belief of Mr. McMurphy that often a contractor or engineer is too close to his problem to see its hazards as readily as the man trained to look for them. It would seem that if this program is followed, accidents should be materially lessened.

The Ohio Branch of the Associated General

Contractors of America has arranged a series of meetings, so that the men doing this work can be brought together. It is hoped that through these meetings there will be brought about a more thorough understanding of the problems of this nature.

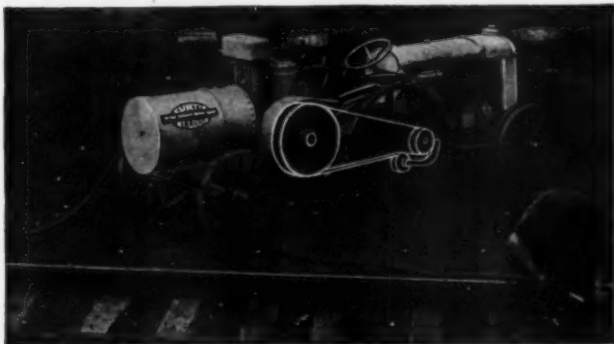
Costs can be materially lessened only by reducing the number and severity of accidents and this can be brought about only by more intensive education on accident prevention and the exercise of greater precautions. The first approach to the problem of safety should be from its humanitarian side. We all should want to reduce the number of accidents, so as to lessen the loss of life and suffering of those injured and the hardships of the dependents. Costs should be secondary and should only be considered as a good business means to the greater end.

The purposes of the practical compensation law conferences of the A. G. C. are to bring together practical men, such as safety engineers, foremen, timekeepers and those in the office.



BUILDING RETAINING WALLS FOR A BRIDGE ON A STATE HIGHWAY JOB IN BELLEVILLE, ILLINOIS
The contractor, George Heelscher, of Smithton, Ill., who built this bridge at Belleville, Ill., used two 4-inch Domestic single-diaphragm pumps to unwater the forms. The pumps were purchased from the George F. Smith Company, St. Louis, Mo.

CURTIS COMPRESSORS, HOISTS, CRANES, CAR WASH SYSTEMS, PORTABLE COMPRESSOR UNITS



Portability aside— what unit compresses air at so low a cost as this Curtis Portable?

While the Curtis Compressor, powered and propelled by Fordson, is the lowest-priced reliable equipment you can buy, its *chief* advantage is not its low first cost. This remarkable unit is also the most economical compressor equipment to operate.

Even on jobs where portability is not an important factor, the Curtis Portable saves money on air compression.

Cheap kerosene fuel is entirely practical, making a real saving. Maintenance costs are absolutely at rock-bottom. As an example, for the cost of overhauling an engine of the type generally used with other

outfits, a complete new Fordson engine could be purchased. No skilled labor is required either for operation or maintenance.

Simply as a compressor, and disregarding its extraordinary ability to move about on its own power, the Curtis proves to be an eye-opener to most contractors. You will revolutionize your equipment-purchasing policy if you investigate this unit thoroughly.

List Price
Curtis Unit Only (STEEL WHEELS)

\$900
SUBJECT TO DISCOUNT

CURTIS

COMPRESSOR

PORTABLE

Both powered and propelled by Fordson Tractor

CURTIS PNEUMATIC MACHINERY COMPANY, ST. LOUIS, U.S.A.

MAIL COUPON TODAY

CURTIS Pneumatic Machinery Co.
1931 Kinslen Ave., St. Louis
Branch Office, 518-1 Hudson Terminal, N. Y.

Gentlemen:

Please send at once full information about the Curtis Portable Compressor, powered and propelled by Fordson tractor. I prefer to deal through [dealer].

Name _____

Address _____

Write character of work in margin or by letter.

Dealers! Get New Business

Dealers who have not been enthusiastic about their Portable Compressor business will do exceedingly well with the Curtis Portable Compressor. This low-priced unit sells readily for all classes of work.

One outfit on your floor shows how one or more Curtis units take the place of an entire "line" of other types. Repeat business is extraordinary, due to the fact that contractors find this unit more universally useful than any other, and therefore purchase more often.

Fleet business also is easily gotten because contractors find they can standardize all their compressor purchases on this one type.

An Improved Backfiller

Unit Developed for Use also as a Light Crane

TODAY the general tendency is for a backfiller to be used also as a light crane. The new Buckeye backfiller made by the Buckeye Traction Ditcher Company, Findlay, Ohio, is a good example of this trend in equipment. While the machine is primarily a back-filler, it can also be used to pull piling and handle pipe, batch boxes, forms, stone, and steel. Equipped with a clam-shell, it will handle loose materials and can clean up after excavation jobs. It has full-circle swing, an adjustable-length boom which increases adaptability, and full-length alligator traction.

Another feature of this equipment is its control. All controls are located in easy reach on the operator's platform. The driver faces the work at all times. The machine travels and is easily controlled with the boom rotated in any direction. It is claimed that under such conditions any mechanic of average ability can produce efficient results. The manufacturer states that a high degree of ruggedness has been built into this machine to readily adapt it for the type of service it is called upon to render.

New Distributor for Monarch Tractors

THE Monarch Tractors Corporation, Springfield, Ill., has announced the appointment of the George B. Curd Equipment Company, 609-611 Reading Road, Cincinnati, Ohio, as distributor for Monarch tractors in the state of Ohio and in Eastern Kentucky. The W. J. Armstrong Supply Company, Sault Ste. Marie, Mich., has been appointed distributor in the northern peninsula of Michigan.



THE NEW BUCKEYE CONVERTIBLE CRANE

A Wood Saw That Operates on a Fordson

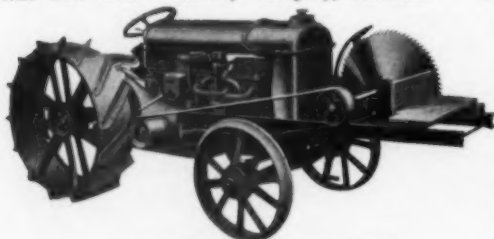
Tractor Easily Operates Saw Up to 30 Inches in Diameter without Any Change in the Machine

THE Fordson Clipper wood saw, which is easily and quickly attached to and detached from a Fordson tractor without making any change in the tractor itself, is made by the American Saw Mill Machinery Company, Hacketts-

town, N. J. The saw table travels on steel rollers and steel tracks, which are attached to the frame of the Fordson as shown in the accompanying illustration.

The side track rails are 3-inch steel channels. There is an adjustment to take up any slack in the belt from the Fordson power take-off to the saw pulley. The pulley is 8 inches in diameter, with a $4\frac{1}{2}$ -inch face, and the belt is 4 inches wide and 12 feet long. Saws up to 30 inches in diameter may be used.

An extension crank is provided for starting the machine, and a mandril wrench is also furnished with each machine. The Clipper wood saw, packed for shipment, weighs only 280 pounds.



THE FORDSON CLIPPER SAW

The new Bear Cat SHOVEL



Real Shovel Work with Bear Cat Economy

THE new Byers Bear Cat Shovel has been designed to meet the demand for a real shovel of half-yard capacity, capable of doing hard work, and economical to buy and to operate.

The rope crowd is easily operated and very fast, faster than the crowd on any shovel that we know of at the present time. It is positive in action, and does not depend upon any other factor in the operation of the machine.

The power and ruggedness of the Bear Cat are so well known as not to need emphasis here. The machine is noted everywhere for its endurance, dependability, and freedom from repairs.

The standard Bear Cat attachments consisting of clamshell, skimmer, etc., all fit the new shovel without change and without removal of any part of the mechanism except the boom.

Send for the new Bear Cat Shovel Bulletin.

THE BYERS MACHINE CO., Ravenna, Ohio
Builders also of Byers Trucks
 Sales and Service Throughout the Country

The Byers Machine Co., Ravenna, O.

Gentlemen—
 Please send a copy of the new Bear Cat Shovel Bulletin. The kind of work we are particularly interested in is.....



BYERS BEAR CAT

THE ALL-PURPOSE ONE MAN CRANE-SHOVEL

Name.....
 Address.....
 City.....
 State.....

C. & E. M. 2-27

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A New $\frac{1}{2}$ -Yard Power Excavator

Unit Built for Small Jobs, Such as Basement Excavation, with Fool-Proof Boom Hoist Braking System

A NEW $\frac{1}{2}$ -cubic-yard-capacity, small, light excavator known as the Model-300 has been brought out by the Harnischfeger Corporation, Milwaukee, Wis. These machines are built primarily for the contractor who specializes in small jobs, such as basement excavations, where exceedingly short tail-swing, ability to travel at

beam.

Like larger P & H models, the new Model-300 is equipped with a patented power clutch control, only $4\frac{1}{2}$ pounds pressure being required to work the levers. It has a fool-proof boom hoist braking system. In addition to a foot-operated brake, hand-brakes, and a pawl and ratchet for holding



THE NEW
P & H
 $\frac{1}{2}$ -YARD
EXCAVATOR

close quarters, power and speed are deciding factors. The tail-swing of this machine is 7 feet $1\frac{1}{2}$ inches, and the swing speed $5\frac{1}{4}$ r.p.m. It is powered with a 50-horsepower gas motor and a hoist independent of the swing and corduroy traction. It can be used with shovel, dragline, clamshell, crane, pile driver or magnet attachment, and for clamshell service it can be equipped with a 30-foot

the boom in a fixed position, it has a lowering control load brake which prevents the boom from dropping.

The car body is of large proportions and the traveling machinery is readily accessible. The revolving frame is a heavy one-piece annealed steel casting extending from the boom hinge to the extreme end of the machine.

Notes of the Trade

The Relay Motors Corporation

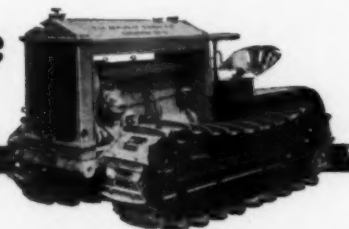
THE Relay Motors Corporation, Wabash, Ind., recently incorporated to take over all the assets of the Commerce Motor Truck Company, of Ypsilanti, Mich., and Service Motors, Inc., Wabash, Ind., has announced the officers of the amalgamated company. W. R. Bassick, Chairman of the Board of Directors of the new company, is known to the automotive world as former Vice-President of the Bassick Company. G. L. Gillam, President of Relay Motors Corporation, was President of Service Motors, Inc., prior to the amalgamation. M. A. Holmes, Vice-President in charge of sales, was formerly Director of Sales for the

Commerce Motor Truck Company and was Vice-President and Sales Manager of the Republic Motor Truck Company. S. E. Houston, is Advertising Manager of the new company.

Hyland Company Made Smith Distributor

THE T. L. Smith Company, Milwaukee, Wis., has announced the appointment of the R. H. Hyland Company, 221 West Huron Street, Chicago, Ill., as distributor for Smith pavers and concrete mixers. The appointment was effective January 1, 1927.

Write to Cletrac and Find Out!



EVERY day you are hearing more about **Cletrac Crawler Tractors**. Latest developments in tractor engineering! New standards of power efficiency! Extraordinary economy of operation!

What does this mean to you—in terms of lower costs for highway building and maintenance? In terms of quicker work and less expensive power? You can find out definitely—and completely—by mailing the coupon below or writing Cletrac today.

Cletrac 30-A

Six-Cylinder Motor
The Tractor Sensation of the Year!

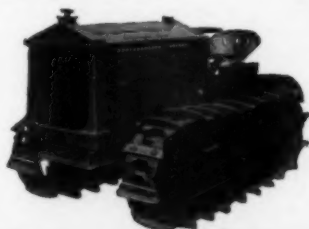
Never before has any tractor caused such universal comment! Never before has a tractor combined so many extraordinary features! Here is power—in proportion to weight—never before attained. A six-cylinder, heavy-duty power plant primarily built for the heavier needs of highway work. Cletrac 30-A has a drawbar horsepower of 38-58 at low speed—a drawbar pounds pull of over 6,000 lbs.—and a high speed rate of nearly 5 m. p. h. It gives full power on both tracks when turning and has plain lower track wheel bearings that require no adjustment. "One-Shot" lubrication oils all but two points outside the motor.

Why not—TODAY—write to Cletrac and find out just what Cletrac has to offer! The coupon or a card will bring all the facts.

THE CLEVELAND TRACTOR CO.
CLEVELAND, OHIO

The Cletrac 20-K—

The smaller Cletrac that has set scores of new records for speed and economy on some of the nation's finest highway jobs. Four-cylinder motor. An ideal unit for road building, maintenance and snow-removal conditions.



Please send full details of: ☐ Cletrac 30-A
☐ Cletrac 20-K

Name.....

Address.....

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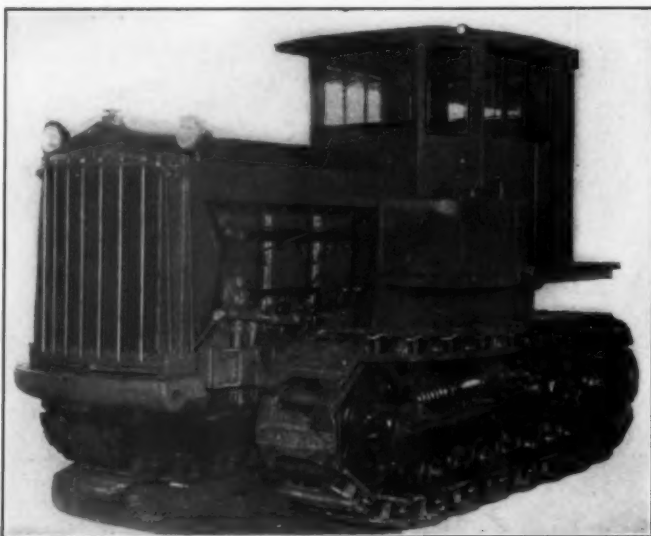
New 75-Horsepower Tractor Under Development

Manufacturer Announces Rapid Progress on Superpowered Crawler Tractor

ONE of the most interesting announcements at the Chicago Road Show last month was that of the Cleveland Tractor Company, Cleveland, Ohio, regarding the new Cletrac "75," a superpowered tractor which the manufacturer claims will develop greater drawbar horsepower and drawbar pounds pull with higher operating speeds than any crawler tractor manufactured today.

Specifications for the new Cletrac "75" include a 6-cylinder, 4-cycle, water-cooled, valve-in-the-head motor, two oil pumps giving ample lubrication

is of six-blade construction, 33 inches in diameter, driven by two V-type endless belts. A Hilliard, pull-type, 12-inch-diameter multiple-disc clutch with clutch brake incorporated, is another feature. The transmission is of the selective type with three speeds forward and one reverse. Steering is accomplished by the effect of the motor through planetary compensating gears, and pressure is applied to either side of the steering brake drums by the steering bands, which slows down the respective track on whose drum the pressure is applied, causing the opposite track to speed up.



THE NEW
CLETRAC-75
CRAWLER
TRACTOR

tion to all movable parts, a Delco semi-automatic dual ignition system, and a Leece-Neville 12-volt double-reduction starting motor and 12-volt generator, with Willard 12-volt heavy-duty battery. A 2-inch Stromberg carburetor is included. All fuel lines leading from the two fuel tanks, each having a capacity of 50 gallons, are of annealed copper tubing. A Pomona clarifier will clean all the air entering the motor. The cooling system has a capacity of 27 gallons of water. The fan

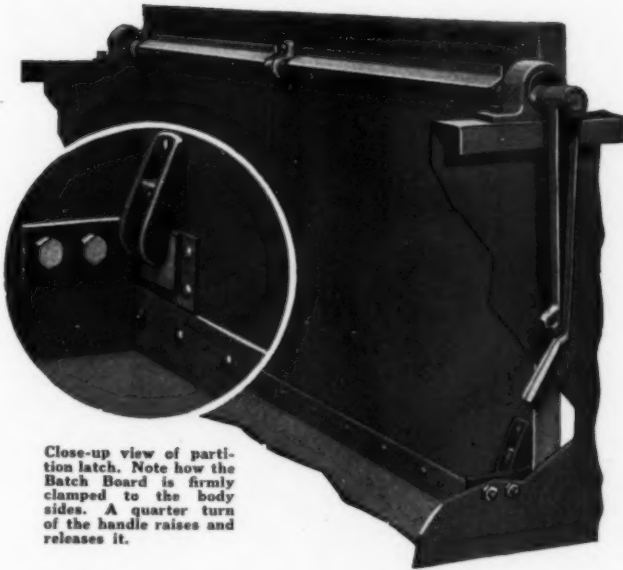
The track shoes are 20 inches wide and the grouters 26 inches wide and 3 inches high. The rated speeds of the tractor are 2.47 miles per hour in low gear, 3.34 in intermediate gear and 5.56 in high gear. The general dimensions of the tractor are length over-all 15 feet, width over-all 98 inches, height over-all, including cab, 9 feet 8 inches, ground clearance 12 inches, center to center of tracks 70 inches. The ratings of the tractor are 75 h.p. at the drawbar and a pulley power of 90 h.p.

Reorganization of Williamsport Wire Rope Company

A SYNDICATE headed by Robert Gilmore, Edgar Munson, Logan Cunningham and C. M. Ballard has purchased the Cochran interests in the Williamsport Wire Rope Company, Williamsport, Pa., thus placing in the hands of old employees the building of what is expected to be the biggest wire rope plant in America. The new organization, while introducing new capital, has not affected the personnel of the old organization which has within the past few years stepped

into the limelight as an important factor in the manufacture and distribution of Telfax marked wire rope.

Robert Gilmore, President, continues as the directing head, having been actively associated with the company for thirty-four years. Edgar Munson becomes Vice-President and Treasurer, Logan Cunningham becomes Vice-President and Secretary, and C. M. Ballard, Vice-President and General Sales Manager.



Close-up view of partition latch. Note how the Batch Board is firmly clamped to the body sides. A quarter turn of the handle raises and releases it.

Heil Batch Board

Heil Swinging Partitions or Batch Boards are made for Heil Quality Dump Bodies and can be installed in any make of dump bodies. The operating mechanism of this batch board and its eccentric feature was developed by Heil Engineers and has been exclusively

PATENTED

The Heil Co. will protect its patent rights against infringement. These partitions are positive in action, simple in design; they cannot get out of order or fail to work.

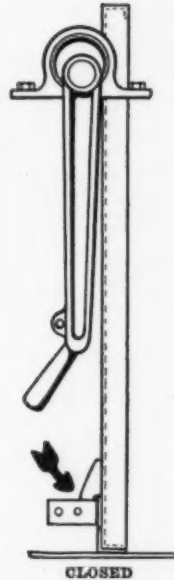
The following information is necessary when ordering Heil partitions: 1. Model and piece No. of Body; 2. Length and width of Body; 3. Height of body sides; 4. Number of partitions required and how spaced. Ask Heil to quote you on Batch Boards for your bodies TODAY. Your inquiry will receive immediate attention.

THE HEIL CO.

1242-60 26th Avenue

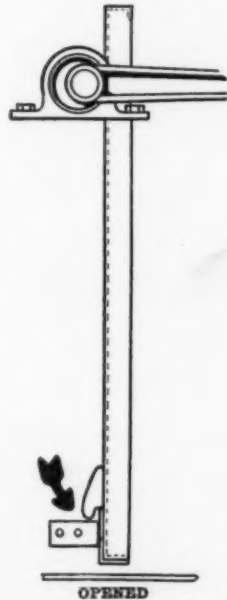
Milwaukee, Wisconsin

Manufacturers Steel Dump Bodies, Hydraulic Hoists, Mechanical Hoists, Hand Hoists, Gravity Dump Bodies, Compartment Truck Tanks, Street Sprinkler Tanks, Storage Tanks of all kinds.



CLOSED

Note that the Heil Batch Board is held in position by a latch fastened to the side of body. There are no holes for set pins in the body floor.



OPENED

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The Work of the Diesel Electric Dredge "Crest"

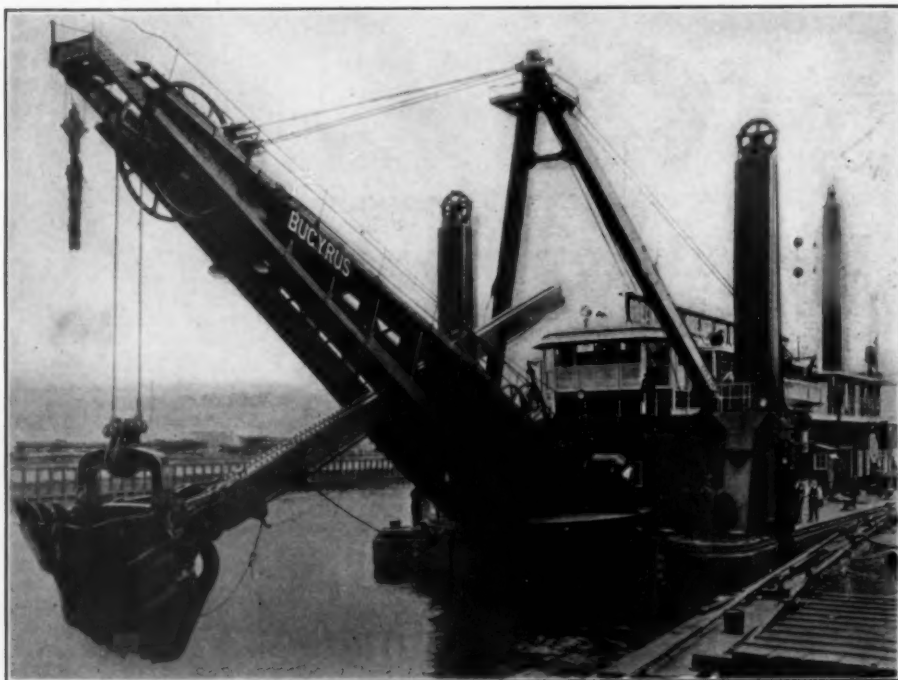
Powerful Unit Has a Dipper Pull of 350,000 Pounds

UTILIZING a dipper pull of 350,000 pounds, more than the pull of the largest dredges used in the construction of the Panama Canal, the diesel-electric dredge "Crest" is now being used for rock removal work in New York harbor off Staten Island. This dredge, 167 feet long and 48 feet wide, is said to be the largest and most powerful dipper dredge ever built.

The dredge is owned by the Great Lakes Dredge and Dock Company and was built by the Bucyrus Company. It is completely electrified, using Gen-

or partly blasted rock. Because of the severity of boat is equipped with 35 electric motors. The its present duty the dipper at present in use has a capacity of but ten cubic yards, although in lighter digging a dipper of 15 cubic yards capacity can be utilized. The dredge is designed to dig to a depth of 52 feet.

Seven main motors, with a total rating of more than 1,400 horsepower are used in the dredging operations. These drive the thrust, hoist, backing, swing and spud machinery. The spuds alone are



TEN-CUBIC-YARD DIESEL ELECTRIC DREDGE "CREST" BUILT FOR THE GREAT LAKES DREDGE AND DOCK COMPANY

eral Electric equipment. The main power-plant consists of two 600-horsepower, Fairbanks-Morse, 6-cylinder, diesel engines of the two-cycle solid injection type, driving direct-current generators supplying 230-volt power. For standby purposes a 120-horsepower two-cycle diesel engine is used. Two 125-volt generators, driven by two 7½-horsepower diesel engines, furnish lighting current for the dredge.

The unusual power of the dredge is necessary because the equipment is designed to dig in blasted

85 feet long and 51 inches square. In all, the main hoist is of the single-part type and operates through twin cables 2¾ inches in diameter, reeved over 9-foot boom-point sheaves.

Besides the electrical equipment described, many conveniences are provided for the crew. Shower-baths with hot and cold water are one of these accommodations, and a social hall is included for the men. The galley is equipped with a cold-storage system. Maxim silencers muffle the noise of the large engines.

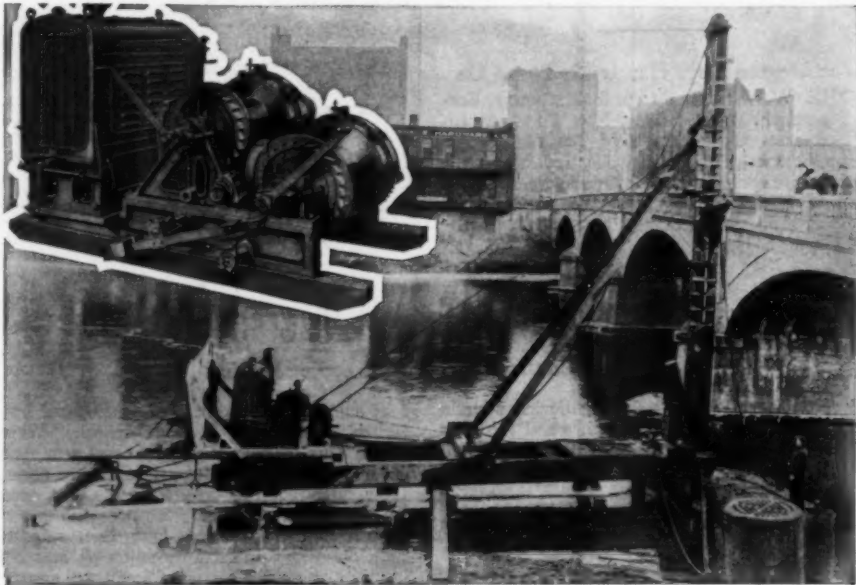
CLYDE

Standard Hoists and Derricks
For the General Contractor
STEAM · ELECTRIC · GASOLINE · BELT

The City of Cedar Rapids, Ia., has utilized an island in the river for community buildings. In this construction it was necessary to build a retaining wall around the island, and do considerable filling to bring the main floor of the building to the bridge level.

A sixty horsepower double drum Clyde Gasoline Hoist was used for driving piles by the Allied Contractors, Inc. of Omaha, who handled the job. Although the hoist handles a 3,500-lb. hammer, it was found that one of 2,500 lbs. was quite sufficient to handle the work satisfactorily. The operators are entirely satisfied with the performance of their hoist.

You'll Take Pride In Your Clyde!



CLYDE IRON WORKS SALES COMPANY

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A Narrow-Bowl Clamshell for Light Cranes

Half-Yard Bucket Has Powerful Block-and-Tackle Closing Gear

A SMALL, narrow-bowl clamshell bucket of half-yard capacity has been developed by the George Haiss Manufacturing Company, 141st Street and Rider Avenue, New York, for use with Bearcat, Universal, and other light cranes for trench digging and excavation in general. An advantage is claimed for the rectangular shaped bowl over the more or less square bowl of the same capacity, as it is said the digging power is directly proportional to the length of the distance from the corner hinge to the center pivot.

The illustration shows the heavy, round, forged connecting rod, the bowl bracing and the large-diameter sheaves. The manufacturer lays stress on the concentration of weight in the lower sheaves housing as particularly desirable in that it does away with the need for counterweights. The claim is also made that the mass weight of the Haiss bucket is so distributed that the jaws will open on any holding line and will dig a full bite in any ground that will yield at all to any other digging bucket.

Worthington Buys Harris Air Pump Co.

THE Worthington Pump & Machinery Corporation, 115 Broadway, New York, has announced the purchase of the Harris Air Pump Company, of Indianapolis, Ind., for some years one of the foremost manufacturers of air-lift systems and air-lift pumps. The purchase was made outright and includes patents, drawings, patterns and good-will.

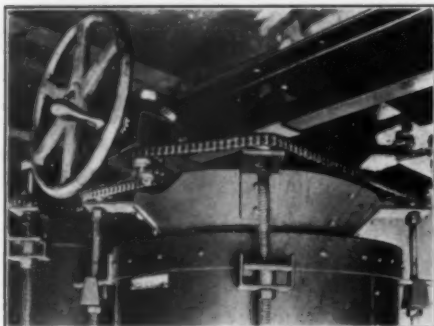


THE NEW HAISS ONE-HALF-YARD HI-POWER CLAMSHELL BUCKET

A New Adjusting Device for Aggregate Batcher

Single Control Wheel Raises or Lowers Unit

A NEW agrabatcher adjusting device wherein the turn of a single control wheel raises or lowers the agrabatcher simultaneously on all



ADJUSTING DEVICE ON HELTZEL AGRABATCHER

four supporting bolts, has been announced by the Heltzel Steel Form & Iron Company, Warren, Ohio. This device consists of a bevel gear set and roller chain and sprockets. It permits of accuracy far greater than ever secured in the past, according to the manufacturer.

Most adjusting devices have been subject to some delay in turning down adjusting nuts either by hand or wrench and then filling the measuring box. The new Heltzel adjusting device eliminates this delay, as a twist of the control wheel geared in a 2 to 1 ratio, gives the desired adjustment to capacity. A scale is provided which shows capacities measuring from 8 to 14 cubic feet on the sand agrabatcher and 13 to 28 cubic feet on the stone agrabatcher. Adjustment is possible to one-eighth of a cubic foot.

The control wheel is located above the agrabatcher, where it can be conveniently handled by an operator working on a platform above the truck and in full view of his work.



Announcement!
Beaver Engines
from 40 to 160 H.P.
are now being made
by the Beaver Division
of
Le Roi Company
MILWAUKEE

ENGINE BUILDERS ONLY

LE ROI ENGINES
NOW RANGE FROM 3 TO 160 HORSE-POWER

The illustration depicts a muscular, shirtless man in a dynamic pose, leaning forward and holding a large, unrolled scroll. The scroll contains the main text of the advertisement. The man's right hand is on the top edge of the scroll, while his left hand points downwards towards a small industrial scene at the bottom right. This scene shows a factory with multiple smokestacks emitting smoke. The background is plain white, emphasizing the man and the scroll. The overall style is that of a vintage technical or industrial magazine advertisement.

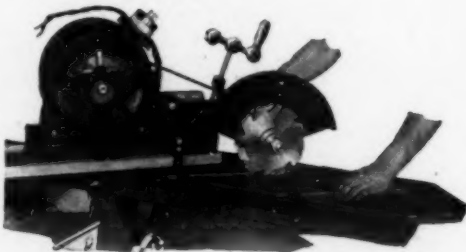
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A Woodworker of Unusual Versatility

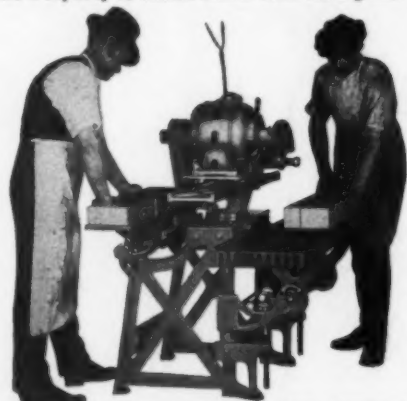
Machine Capable of Twelve Distinct Operations

THE Detroit Woodworker, made by the Master Woodworker Manufacturing Company, 616 Brush Street, Detroit, Mich., is made in four models, Nos. 15, 23, 14 and 16, the chief difference between them being in size and the size of material handled. These machines are guaranteed to rip 6-, 4-, 2-, and 1-inch stock, respectively, at rates of 15, 10, 30 and 30 lineal feet per minute, respectively.

The largest-size machine, the Model 15, operates on a three-phase, 440-volt line. It weighs 1,600 pounds, has a motor of 4 to 5 horsepower and a capacity to handle 8-inch cross-cutting and



THE DETROIT WOODWORKER HOUSING OUT A STAIR STRING



THE WOODWORKER RIPPING AND JOINTING FROM THE UNDERSLUNG MANDREL

6-inch ripping. It is 5 feet long, 4½ feet wide, and 6 feet high, and the jointer is 6 x 42 inches. The table size is 18 x 60 inches.

The Detroit woodworker, which is virtually twelve machines in one, can handle the following different operations; cross-cutting; ripping; jointing; boring; sanding; dadoing; planing; routing; plowing; mitering; rabbeting; molding; band-sawing; mortising; tenoning; grinding; matching; stair routing, and cuts a side door jamb and jack rafter in one operation. The most important feature claimed for this machine is that the saw cuts its way naturally through the lumber, thus eliminating binding and saving a large amount of power over the old method of pushing the lumber against the saw, which in most cases required two men to handle long planks.

Improvements in Light-Weight Excavator

Better Lubrication and Longer Boom with Backfiller Attachment Available

IMPROVEMENTS in the type-C Insley excavator made by the Insley Manufacturing Company, Indianapolis, Ind., have been announced recently. The excavator is now furnished with a completely enclosed steel cab equipped with swinging windows and sliding steel panels which provide ample light for the operator and complete accessibility to every working part. At the same time it gives a maximum of protection to the machinery.

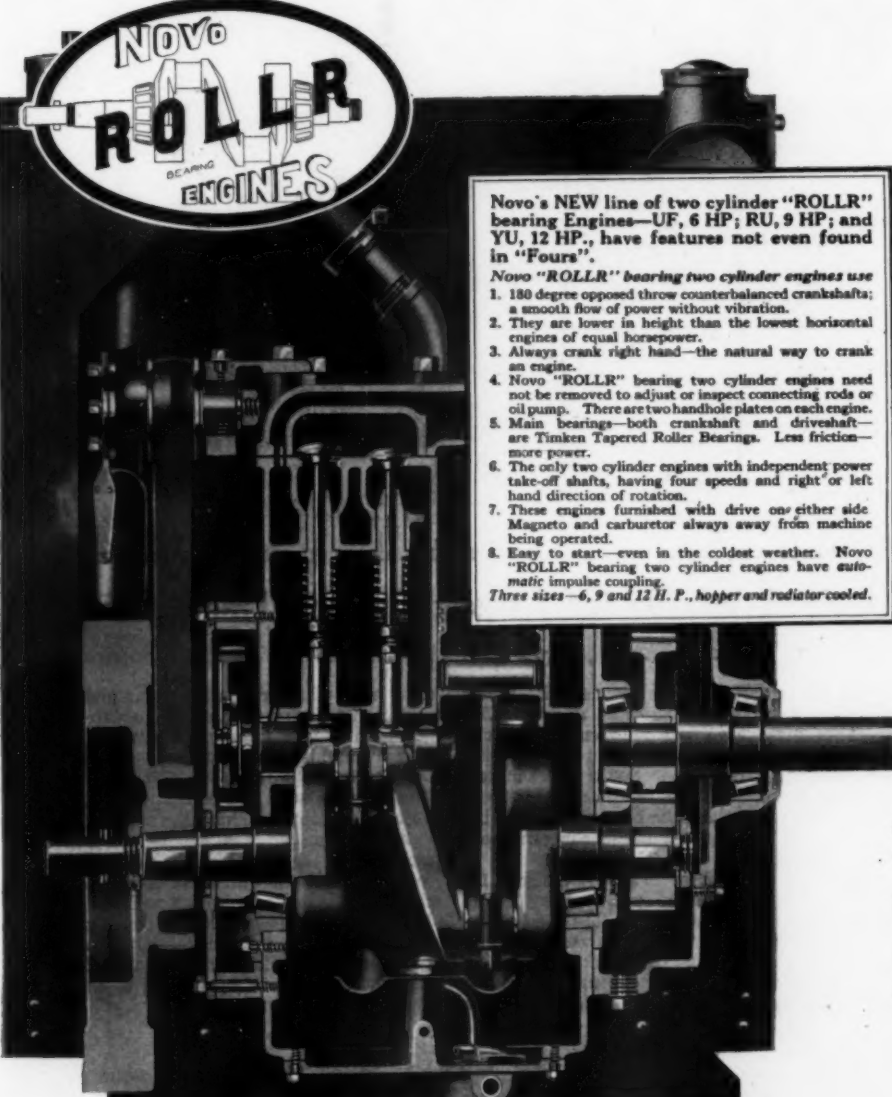
Another improvement is the adoption of the one-shot lubricating system for the crawler rollers. In the past the moving of an excavator under its own power over a long distance has presented something of a problem in keeping the crawler bearings properly lubricated. This sometimes necessitated the use of a lubricating gun three or four times during a trip of five miles. With the one-shot system, it is never necessary for the operator to leave his seat to oil the rollers, as this system is controlled by a cylinder and plunger mounted in front of the control levers within easy reach of the operator's feet.

Another addition is a backfiller attachment with



ONE-SHOT PRESSURE LUBRICATION ON CRAWLER TREAD OF INSLEY EXCAVATOR

a 30-40-foot telescopic boom which can be extended to a length of 50 feet by the addition of a 10-foot intermediate section if desired.



NOVO
ROLLR
BEARING
ENGINES

Novo's NEW line of two cylinder "ROLLR" bearing Engines—UF, 6 HP; RU, 9 HP; and YU, 12 HP., have features not even found in "Fours".

Novo "ROLLR" bearing two cylinder engines use

1. 180 degree opposed throw counterbalanced crankshafts; a smooth flow of power without vibration.
2. They are lower in height than the lowest horizontal engines of equal horsepower.
3. Always crank right hand—the natural way to crank an engine.
4. Novo "ROLLR" bearing two cylinder engines need not be removed to adjust or inspect connecting rods or oil pump. There are two handhole plates on each engine.
5. Main bearings—both crankshaft and driveshaft—are Timken Tapered Roller Bearings. Less friction—more power.
6. The only two cylinder engines with independent power take-off shafts, having four speeds and right or left hand direction of rotation.
7. These engines furnished with drive on either side. Magneto and carburetor always away from machine being operated.
8. Easy to start—even in the coldest weather. Novo "ROLLR" bearing two cylinder engines have automatic impulse coupling.

Three sizes—6, 9 and 12 H. P., hopper and radiator cooled.



NOVO ENGINE CO.

Clarence E. Bement, Vice-Pres. & Gen. Mgr.
Main Office and Factory - Lansing, Michigan, U. S. A.



ENGINES — HOISTS — PUMPS

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TRACTOR EQUIPPED WITH LARGE-SIZE FRENCH & HECHT WHEELS FOR RUBBER TIRES

Steel Wheels for Largest Rubber Tractor Tires

Tractors Thus Equipped for Industrial and Road Building Service

STEEL expansion wheels for use with rubber tires 50 inches in diameter by 10 inches wide have been developed by French & Hecht, Davenport, Iowa. The development of these massive tires was brought about by the wheel makers in cooperation with the rubber tire manufacturers. Tires of this diameter have been used before but never in this extreme width with one continuous ring of rubber.

These new wheels were originally designed for use on McCormick Deering 15-30 tractors for road building and maintenance work. The solid rubber tires are of the same type as those used for motor truck service and have a non-skid or tractor tread.

A special feature of the expansion wheels is that extension wheels can be added to provide

either 10 x 5-inch triple rubber tires giving a road contact of 15 inches wide, or two 50 x 10-inch tires, making a 20-inch face for each wheel. The extension wheel is bolted at its rim to the main wheel by 6 bolts and through the hub by seven bolts. This makes a solid unit of the two wheels. The main wheel proper without the rubber tires is 44 inches in diameter and has 28 one-inch round spokes while the extension has 16 one-inch round spokes. The front wheels are also of the expansion type having 34 x 5-inch solid rubber tires. No power press is required to mount or remove these rubber tires. Expanding edges in the steel rims make it possible, with the use of a heavy hammer and an ordinary wrench, to change tires quickly.

Speeding Up Sewer Construction

Increased Use of Construction Machinery Aids Contractors

IN addition to preventing damage to sidewalks and lawns, Louwers and Somerville, contractors, Detroit, Michigan, are breaking records in the digging of trenches and laying of sewer pipe. The sections of pipe, weighing 4,100 pounds each, have been stored along the edges of private lawns just inside of sidewalks along the streets down the middle of which a sewer is being installed. The usual method of handling the sections of pipe would be to pull them across the sidewalk to the center of the road by means of a dragline cable,

where they would be lowered into place.

Because of the weight of the sections of pipe and the difficulty in handling them by pulling across the street, this practice has often resulted in badly defaced lawns and cracked sidewalks. To eliminate this hitherto unavoidable damage, the contractor used a McMyler-interstate gasoline crane to move the piping. Following the trenching machine down the middle of the street, the crane is operated so that the boom reaches over to the lines of pipe sections, a section is attached and is

GALION Gets Its "ABUNDANT POWER" from



Galion Master Roller
in operation on Lin-
coln Highway near
Greensburg, Penna.

CLIMAX

The "Trustworthy" Engine

The same "Trustworthy" Engines as supplied by us to the accompanying list of well-known builders of high-grade machinery, are also available in 17 different types of Portable and Semi-Portable Power Units for every purpose, where from 25 to 140 H. P. is required.

Write for Bulletin E

CLIMAX ENGINEERING CO., 1 W. 18th Av., Clinton, Iowa

Eastern Branch: 39 E. 42nd St., New York, N. Y.
Cleveland Branch: 657 Leader Bldg., Cleveland, O.
Chicago Branch: 2007 Harris Trust Bldg., Chicago
Los Angeles, Calif.: Coast Machinery Corporation,
464-66 E. 3rd St.
San Francisco, Calif.: Const Machinery Corporation,
429 Fulton St.
Birmingham, Ala.: Kelsor-Gelmer Engineering
Co., 1308-9 American Trust Bldg.
Boston, Mass.: Rapp-Hockins, 60 Haverhill St.

Denver, Col.: The Hendrie & Bolhoff Mfg. & Sup-
ply Co., 1821-23 11th St.
El Paso, Texas: Sheehan & Co., 1516 Bassett Ave.
Jackson, Miss.: Anderson Sales & Distributing Co.,
Jacksonville, Fla.: Construction Equipment Co.,
451 East Bay St.
Madison, Wis.: Wisconsin Machine & Foundry Co.
Minneapolis, Minn.: Wm. H. Ziegler Co., 619 Wash-
ington Ave. S.
St. Louis, Mo.: Tully Equipment Co., 2830 Pine St.

Portland, Ore.: J. L. Latture Equipment Co., 254
Belmont St.
Indianapolis, Ind.: Carl Dunning Supply Co., 204
W. Maryland St.
Omaha, Neb.: Interstate Machinery & Supply Co.
Louisville, Ky.: Solman Hardware Co.
New Orleans, La.: Woodward, Wight & Co.,
451 Howard St.
Montreal, Que., Can.: Edward C. Dingman, 1085
Keefer Bldg.

Among Road Rollers, the "Galion Master Four-Cylinder" is a recognized leader. In the new illustrated catalog published by the Galion Iron Works & Manufacturing Company of Galion, Ohio, the manufacturers tell why this Roller is powered by a 55 H. P. heavy-duty, slow-speed Climax "Trustworthy" Motor.

They say: "This Motor was designed especially for heavy industrial service and its use in Galion Master Rollers has been justified by the satisfaction it is giving to owners. The superiority of its Climax "Trustworthy" Motor is one of the important points of superiority in the Galion Master Roller."

Leading Manufacturers Using Climax as Standard Equipment

Bay City Dredge Works, Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, Ohio
Browning Crane Co., Cleveland, Ohio
The Buhl Co., 407 S. Dearborn St., Chicago, Ill.
Davenport Locomotive Works, Davenport, Iowa
Fate-Root-Heath Co., Plymouth, Ohio
Four Drive Tractor Co., Big Rapids, Mich.
Galion Iron Works & Mfg. Co., Galion, Ohio
Greiman Ditcher Co., Inc., Garner, Iowa
Industrial Works, Bay City, Mich.
J. T. Tractor Co., Cleveland, Ohio
Kennison Mfg. Co., Solomon, Kans.
Keystone Driller Co., Beaver Falls, Pa.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill.
McMyler-Interstate Co., Cleveland, Ohio
Mid-West Locomotive Works, Cincinnati, Ohio
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Moore Speedcrane Co., Chicago, Ill.
Mundie Manufacturing Co., Peru, Ill.
Northern Pump Co., Minneapolis, Minn.
O. K. Clutch & Machinery Co., Columbia, Pa.
Orton Crane & Shovel Co., Chicago, Ill.
Parsons Co., Newton, Iowa
The Russell & Co., Massillon, Ohio
Vulcan Iron Works, Wilkes-Barre, Pa.
Geo. D. Whitcomb Co., Rochelle, Ill.
Wisconsin Foundry & Machine Co., Madison, Wis.

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A McMYLER-INTERSTATE DRAGLINE WITH EQUIPMENT FOR LAYING CONCRETE SEWER PIPE

swung back to the street center and lowered into the trench. This method of pipe handling, originally adopted as a means of preventing damage to sidewalks, has been found to so facilitate the operation that sewer construction records are being broken continually.

According to the reports of the officers of the construction company, where the general speed of digging a trench ranging from 12 to 17 feet deep by 56 inches wide and laying 42-inch diameter pipe is about 150 feet per day, it has been possible by the use of the gasoline-operated crane to lay as much as 1,100 feet of sewer in $4\frac{1}{2}$ days. In spite of rainy conditions, 360 feet of pipe were laid in the course of a single day and during ideal conditions the contractors expect to set a record of 500 feet. Such speed should reduce the cost of laying sewers and result in material savings to all concerned.

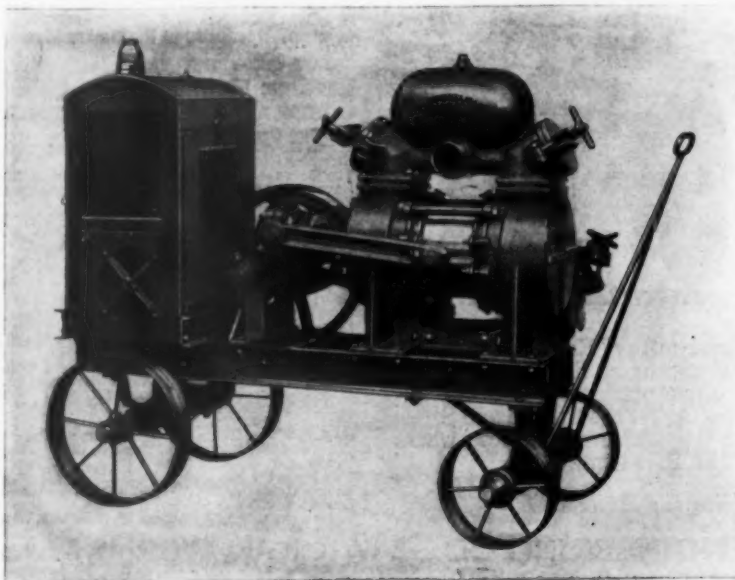
A New Double Four Lift and Force Trench Pump

Unit Capable of Handling 250 Gallons per Minute Against Head of 50 Feet

THE new Humphries double four lift and force trench pump with a capacity of 250 gallons per minute was exhibited for the first time at the Chicago Road Show, by the Humphries Manufacturing Company, Mansfield, Ohio. This pump is compact and of sturdy construction.

be examined or removed without the use of a wrench or tool of any kind.

The horizontal brass-cased outside-packed plunger is another feature which eliminates expenses and delay in diaphragm replacement. The outside packed feature makes it possible for the

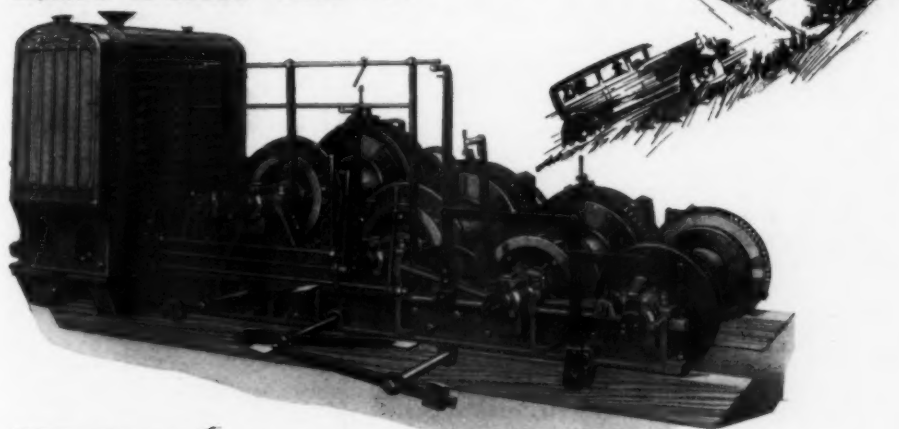


THE
HUMPHRIES
DOUBLE FOUR
LIFT
AND
FORCE
TRENCH
PUMP

Special effort has been made in the design of the pump body and waterways to eliminate all settling points. The rubber ball valves are non-clogging, which makes it possible for the pump to handle large amounts of solid matter. Accessibility is stressed by the manufacturers, as the valves can

packing to be kept tight at all times without stopping the pump. By keeping the packing tight, the pump is suited for practically any type of drainage work. A suction lift of 25 feet is guaranteed and the pump can be operated under a maximum total lift and head of 50 feet.

Like a fine car . . .



Power on the Up-grades Speed on the Straightaway

TRADE MARK
MUNDY
ESTABLISHED 1869

The New Patent Three-Speed Hoist is fully protected by patents in the United States and Canada.

Some open exclusive sales territory is now available.

POWER for the steep grades and the heavy going . . . speed for the straightaways. That's what the modern fine car has . . . and what the "horseless carriage" lacked. It's the combination that the New Three-Speed Mundy Hoist has . . . and that the old-fashioned hoists lacked.

Now no more slow hauls on light loads . . . the Mundy Patent Three-Speed Hoist speeds along—420 ft. per minute, with a line-pull of 5,000 lbs.—until the going is heavier. Then, in ten seconds, it adapts itself to the changed condition of load.

Just a shift of gears . . . instead of

an hour's reaving-change . . . and you have a complete change of speed and line-pull.

Speed on the light loads . . . the "straightaways." And power on the heavy loads . . . the "upgrades." That means new standards of efficiency . . . and new savings. Bulletins ready for the asking.

The Mundy Sales Corporation

Distributors for the J. S. Mundy Hoisting Engine Co.

30 Church St., New York

Agents in Principal Cities

MUNDY HOISTS

The Hoist With The Asbestall Frictions

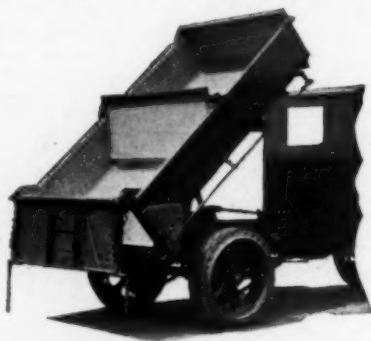
When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you.

Swinging Partitions for Motor Truck Dump-Bodies

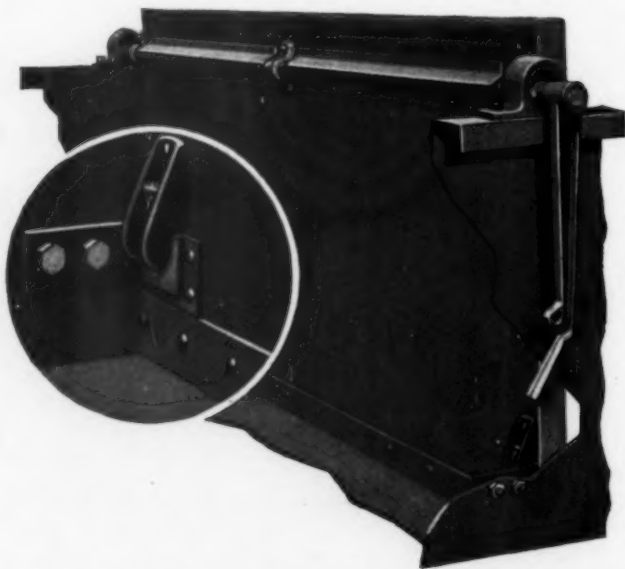
Adjustable Batch-Boards Now Available to Increase Efficiency in Unloading at Mixer

THERE has been a decided tendency of late for contractors and truck owners operating on cement and concrete mix jobs to use dump-bodies equipped with swinging partitions on their motor trucks. With the dump-body correctly divided for batch loads, it is far more efficient in unloading at the skip of the mixer to release the load one batch at a time.

The idea of eccentric control for the operation of the batch-board of swinging partition has been developed and patented by the Heil Company, Milwaukee, Wis. The accompanying illustration shows the principle of its operation. When the operation handle for the batch-board is raised, the partition is lifted up about one inch by the action of the eccentric and released from its latch so that the load swings the partition over as it dumps out.



A HEIL BATCH-BOARD OR SWINGING PARTITION IN A DUMP-TRUCK



CLOSE UP OF
PARTITION LATCH
ON NEW HEIL BATCH-
BOARDS

To lock the batch-board in position again with the body lowered, the operating handle is pulled down, thus bringing the partition back so that it automatically hooks itself to the latch on the inside of the body. A Heil batch-board or

swinging partition consists of a divider plate of steel flanged over at all edges to give stiffness. The flanges are turned away from the load. These batch-boards are made for any make or model of dump-body.

Changes in Harnischfeger Southern Offices

THE Harnischfeger Corporation, Milwaukee, Wis., has announced the removal of its branch office at Jacksonville, Fla., from the Peninsular Casualty Building to 509 East 8th Street. F. W. Truex is Branch Manager in charge. After

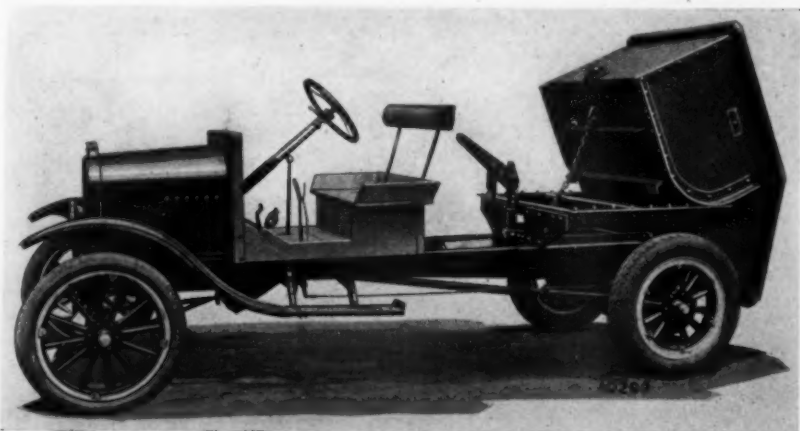
March 1, the Jacksonville branch warehouse will also be moved from its location at 1465 Kings Road to 509 East 8th Street, thus combining the office and warehouse to make possible still better service to users of P & H equipment.

EASTON RAPIDUMPS



HAND LOADING is easy with EASTON RAPIDUMPS. You will find them around quarries, brick yards, and industrial plants giving efficient and economical service. They operate quick, easy and automatic. The driver need not stop to unload keep right on going with RAPIDUMPS and save that time each trip.

NEW LOW PRICES NOW IN EFFECT



EASTON CAR & CONSTRUCTION CO.
EASTON, *Offices and Works* **PENNA.**

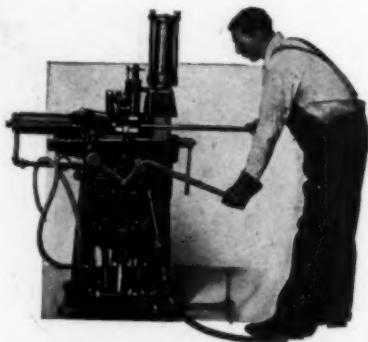
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A Light Drill-Steel Sharpener

Machine Is Compact for Easy Moving and Handles Hammer-Drill Steel Bits and Shanks

THERE is a large group of contractors, including road and street contractors, city and county highway officials, as well as those in general construction jobs and excavating, tunneling, grading, quarry operations and the like, who can effectively use a power sharpener which is light and compact enough to be moved easily and yet able to make ordinary hammer-drill steel bits and shanks effectively.

The savings which result from improved bits and shanks on the steel soon pay for the machine, and tools can be kept in first-class condition by an inexperienced man. Cutting stone requires well-made bits carefully tempered to insure maximum production from rock-drills, spaders or concrete busters. Many jobs lose money for lack of steel which will really cut the stone. The best is none too good. The new Type-C sharpener made by the Sullivan Machinery Company, 162 South Michigan Avenue, Chicago, Ill., weighs about 1,100 pounds and occupies a floor space of approximately $3\frac{1}{2}$ x $2\frac{1}{2}$ feet. It may be mounted on timbers or skids



UPSETTING A BIT BY THE HORIZONTAL HAMMER OF A SULLIVAN TYPE-C LIGHT DRILL SHARPENER

drills have been selected for the work to be done, or how efficient they may be, poor drill-steel, steel



A SULLIVAN TYPE-C SHARPENER IN USE BY MILLER, HAYNES & GILLETTE CORPORATION, NEW YORK STATE ROAD CONTRACTORS

for easy handling. The machine is capable of making and rehandling any ordinary hammer-drill bits up to $2\frac{1}{2}$ -inch gage, and of forging collar-shanks on $\frac{7}{8}$ -inch or 1-inch solid or hollow steel, and of putting pick and chisel points and concrete-breaker shanks on $1\frac{1}{8}$ -inch steel.

The Type-C sharpener may be operated successfully by a Sullivan portable air-compressor without interfering with the use of drills or concrete breakers on the same line and the compressor operator or a drill runner can also make the bits and shanks on the sharpener as no special training is required to handle the machine effectively.

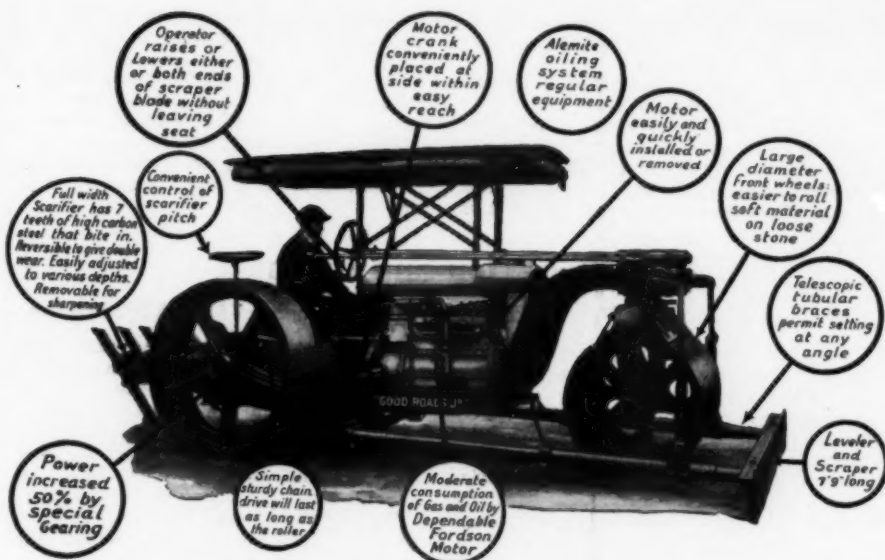
Importance of Drill-Steel

The importance of proper drill bits cannot be too strongly urged. No matter how carefully the

improperly forged or tempered or bits of unsuitable shape or not uniform in gage, will nullify the excellence of the drilling machine. It may be said truly that the entire organization is pyramided on the drill bit. Poor bits mean lost holes, undue drill wear and breakage, delay in repairing them, lost time and curtailment of output. There is no better insurance of satisfactory progress or production for the mine, quarry or contract than an adequate supply of good drill steel properly sharpened, shanked and tempered.

The advantages of machine forging of drill bits include:

Uniformity.—Bits are perfect in shape, with all wings of the specified length, thickness and angle of cutting edge. Bits are made to the exact gages called for and the steel in a set "follow" in the



A complete road-building outfit —in one machine!

Everything for the Road Maker

Road Graders
Road Drags
Road Oiling Machines
Heating Kettles
Rock Crushers
Steam Road Rollers
Tandem Rollers
Engine and boiler
Corrugated Culvert Pipe
Gravel Screening Plants
Car Unloaders
Road Plows
Rooter Plows
Drag Scrapers
Wheel Scrapers
Dump Wagons
Sand and Gravel Plants
Street Sweepers

Send
for Catalog



TRADE

MARK

THE Good Roads Jr. Roller helps public officials to stretch appropriations—helps contractors to submit low bids without sacrificing profits. Road roller, scarifier, scraper and leveler—all in one—it keeps down costs by keeping down investment—and by speedy, efficient work, and long life.

With a Good Roads Jr. you can

- A—Scarify a dirt, gravel, cinder or stone road
- B—Plane, grade or form the road bed
- C—Roll roads or drives—new work or maintenance
- D—Pull a sprinkler or grader or wagons loaded with materials

Costs little to operate: gas and oil consumption is very moderate. Easy to handle: anyone who can manage a Fordson can manage the Good Roads Jr.

We'll gladly arrange a demonstration. Write today for catalog describing this and other money-saving Good Roads machines.

THE GOOD ROADS MACHINERY CO., Inc.
KENNETT SQUARE, PENNA.

Watertown, Mass. . . . 36 Pleasant St.	Chicago, Ill. . . . 49th & Halsted Sts.
Portland, Ore. . . . 3rd & Hawthorne Sts.	Pittsburgh, Pa. . . . 1523 Oliver Bldg.
San Francisco, Cal. . . . 26 Fremont St.	Atlanta, Ga. . . . 569 Whitehall St.
Los Angeles, Cal. . . . 931 Santa Fe Ave.	New York, N.Y. . . . 50 Church St.
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Good Roads MACHINERY

When writing to advertisers, please mention the Contractors' & Engineers' Monthly—Thank you

holes insuring steady progress and reducing the danger of stuck bits with the resulting delay and wear and tear on the drills.

Less idleness.—The drills and their operators are not left idle for lack of sharp steel.

Labor economy.—A smith and a helper can handle as much steel on a modern sharpener as several crews sharpening by hand.

These advantages and their stimulating effect on drilling progress are so important that the

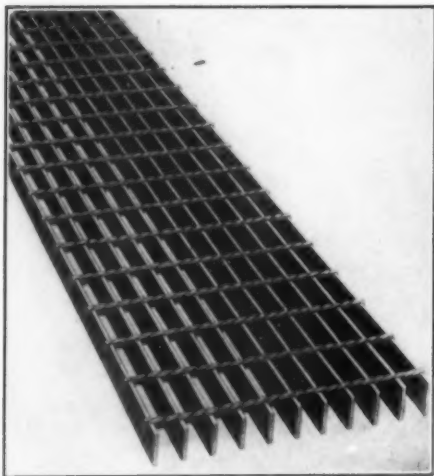
mechanical drill sharpener has come to be regarded as almost as essential as the steel itself. Even if only two or three rock-drills or hammer-drills are regularly used, the quality of bits and shanks made, plus the economy of time gained, and the increased drilling speed, will warrant installing a sharpener. The surplus time of the smith, in such a case, can frequently be applied to repairing drills, keeping track of spare parts, etc.

A New Non-Slip Grating

Product Made Up by Welding Eliminates Loss of Strength Through Rivet Holes

THE new Security grating manufactured by the Blaw-Knox Company, Pittsburgh, Pa., represents a distinct departure in manufacturing methods from the usual type of non-slip gratings. It is made by means of a resistance welding process in which longitudinal bars and crossbars are welded into one-piece construction. The full value of the metal is utilized, there being no slots or rivet holes to detract from the strength of the structure.

In a series of tests, first conducted at Columbia University, New York, and lastly under the auspices of the Pittsburgh Testing Laboratory, this Security grating showed remarkable strength.



THE NEW BLAW-KNOX NON-SLIP GRATING

The twisted crossbars are practically positive in preventing slipping as more than one of them is always in contact with each shoe of the person crossing a section of grating, presenting a surface on which slipping is practically impossible. The crossbars are slightly raised above the level of the longitudinal bars so that the foot is at all times in contact with the non-slip surface.

The appearance of the grating is shown in the accompanying illustration. The lighting qualities of this steel grating are remarkable as there is a minimum of opaque material interposed between the outside source of light and its object below.

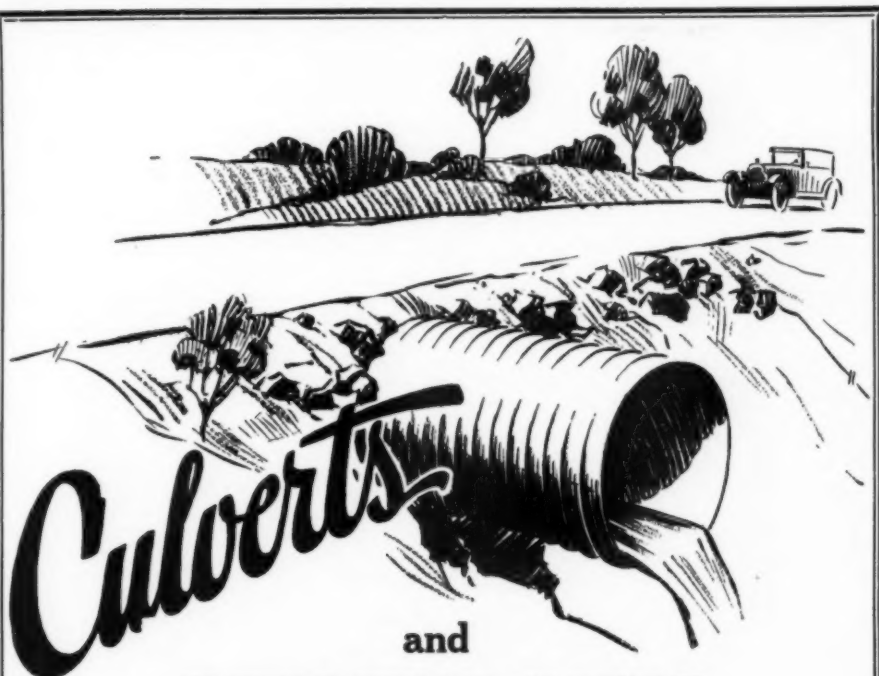
Galvanized security grating is strongly recommended by the manufacturer for either indoor or outdoor use, as the slight difference between the cost of galvanizing and that of painting is justified from the point of maintenance cost and appearance. Two repainting, or at the most three, will cover the additional cost of galvanizing, and painting must necessarily be renewed every three years at least. It is a well-known fact that proper galvanizing forms a protective coating that will last indefinitely and ultimate economy results through the use of the galvanized grating. The attractive appearance of the galvanized grating is also a factor to take into consideration, the galvanizing giving a surface which reflects light and thus increases the lighting capacity of the grating, whereas dark paint absorbs the light rays which encounter its surface.

Standard Blaw-Knox Security contains 11 longitudinal bars to the foot and the crossbars at the top are spaced on $2\frac{1}{2}$ -inch centers. The longitudinal bars are $\frac{3}{8}$ to $\frac{3}{16}$ -inch thick as required, and the crossbars are of sufficient section to properly brace and develop the strength of the longitudinal bars.

New Mundy Distributors in Michigan, Wisconsin and Iowa

CHARLES H. FOSTER, Secretary, The Mundy Sales Corporation, 30 Church Street, New York, has announced the following appointments of new distributors: W. H. Anderson Tool & Supply Company, Grand Rapids, Mich., as exclusive distributor for Mundy hoisting equipment in western Michigan; Cyril J. Burke, De-

troit, Mich., to handle all of eastern Michigan with the exception of Lenawee and Monroe counties; Cunningham-Ortmayer Company, Milwaukee, Wis., as exclusive distributor for the state of Wisconsin; and R. W. Simpson, Cedar Rapids, Iowa, as exclusive distributor for the Mundy line in Iowa.



and STRENGTH

99.875% Pure Iron Copper Alloy

"Corrugated for Strength; Galvanized for Long Life"

Beauty that is strong; strength that is beautiful.—More important than eye-pleasing features are the facts of long, uninterrupted service, under tremendous road loads. Newport Culvert holds the load of traffic. A good road is better wherever Newport Culvert is used. Made in all sizes and in multiples of two feet.

Acceptable wherever utmost service is required at least cost. Easily installed by unskilled workmen, Newport Culvert avoids expensive renewals or repairs. Let our engineering department help solve your drainage problems. This genuine service is yours. Write us with no feeling of obligation; service is our business; Newport Culvert is our success.



Valuable special culvert handbook "A" is yours for the asking. Write for it today.



Silent Aids for You

THE catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

A ONE-TON FORDSON CRANE

The W & K one-ton Fordson crane, which has been developed to fill a need existing for a light, fast, portable crane, capable of handling one-ton loads and yet flexible enough to be maneuvered readily in congested areas, is described completely in literature which may be secured from N. L. Leslie, Whitehead & Kales Co., Detroit, Mich.

A NEW HALF-YARD GASOLINE SHOVEL

The Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., has just issued its Bulletin No. 42 describing the new Orton Model "V" one-half-yard gasoline shovel, which has many features of interest to contractors handling basement excavation or road grading.

A TRENCHER THAT WILL CUT MANY WIDTHS

The rotary auxiliary cutter permits any Buckeye excavator to dig several widths or sizes of trench, often eliminating the need for an extra machine, yet this excavator costs no more than an ordinary excavator of limited digging ability. Write for the literature of the Buckeye Traction Ditcher Co., Findlay, Ohio, describing this and other excavators, ditchers and back-fillers manufactured by this company.

A NEW CONCRETE ADMIXTURE

"Colloy," an admixture material specially prepared for use in all types of concrete is a concentrated colloidal and effects a marked improvement in the quality of concrete, making it more workable, more water-tight, improved in appearance, of higher strength, greater uniformity, makes possible the use of dryer consistencies, gives increased density, prevents segregation, reduces variation, reduces manipulation, gives increased capacity, and reduces costs. This material is described completely in Form 201-A which may be secured from the Colloy Production Co., 4030 Chouteau Ave., St. Louis, Mo.

A SURE WAY TO CUT TRUCK MAINTENANCE

There are lots of cities and contractors in this country who have reduced truck repair bills, kept trucks in constant use, prevented upward throw and side-away, and have generally lengthened the life of the truck and body by the use of Gruss air-springs. Complete information regarding Gruss air-springs may be secured from the Cleveland Pneumatic Tool Co., Cleveland, Ohio.

CENTRAL MIXING PLANTS

The Erie Steel Construction Co., Erie, Pa., will be pleased to send information regarding central mixing plants of from 30 to 200 tons capacity, which they manufacture, or on special plants which they are prepared to design to meet particular requirements.

CONCRETE MIXERS THAT SPEED UP JOBS

If you are interested in a concrete mixer that will speed up your building job, write to the Ransome Concrete Machinery Co., Dunellen, N. J., for complete information on Ransome concrete mixers.

THE RIGHT POWDER FOR THE JOB

The Hercules Powder Co., 958 King Street, Wilmington, Del., will be pleased to send information regarding the right kind of powder you need for a particular job.

SIMPLE COMPACT POWER-PLANTS

Complete information regarding Hercules on-the-job engines, which are known for simplicity and compactness, may be secured from the Hercules Motors Corp., Canton, Ohio.

A BALANCED HAND-POWER SAW

The Alta Power Saw, which easily cuts three-inch material and which has a telescoping safety guard and wide carrying shoe, is completely described in the literature of the Wappat Gear Works, Meade Street and Braddock Ave., Pittsburgh, Pa.

A CONCRETE HEATER FOR TILTING DRUM MIXERS

No. 235 Hauck kerosene concrete heater equipment for all tilting drum mixers, and which is used without overhead frame structure on all mixers up to and including 5 cubic feet mixed concrete capacity, is completely described in a new circular issued by the Hauck Manufacturing Co., 149 Tenth Street, Brooklyn, N. Y.

CLAMSHELL BUCKETS

Catalog 425, recently issued by the George Haiss Mfg. Co., Inc., 142nd Street and Park Ave., New York City, describes Haiss clamshell buckets in the "Contractor," "Lever-arm," and "Hi-Power" types, in all sizes.

GRADER BLADES THAT LAST LONGER

The Shunk Mfg. Co., Bucyrus, Ohio, has recently issued a new folder, "Why Shunk Grader Blades are Superior in Quality and Workmanship and Will Give Better Service and Longer Wear." This folder gives illustrations showing the manufacture of these blades and a history of the organization, as well as data on the blades themselves.

A ONE-MAN TUNNEL AND SUBWAY SHOVEL

The Conway shovel composed of three elements, a mine locomotive frame, a dipper that digs, and a belt-conveyor that carries the material to the cars, all operated by one man in small headroom, is described completely in the latest literature of the St. Louis Power Shovel Co., 322 Chemical Building, St. Louis, Mo.

A POWER GRADER WITH CHOICE OF TRACTOR

The Shawnee power grader is now available in unit types with Fordson and International 10-20 power and in quick detachable types with hook-ups for Caterpillar 2-ton and International 10-20 tractors. Complete information regarding this may be secured from the Shaw-Enochs Tractor Co., 2416 University Ave., S. E., Minneapolis, Minn.

CONCRETE HEATERS AND THAWING TORCHES

The latest illustrated catalog of the Aeroli Burner Co., Inc., Union City, N. J., describes Aeroli smokeless oil-burning concrete heaters, thawing torches, portable water heaters, asphalt melting kettles, salamanders, mortar-heating pans, sand and gravel heaters and lead-melting furnaces.

A BOOK OF TRUCK FLEETS

The Indiana Truck Corporation, Marion, Ind., has just issued a booklet giving the records of fleets of Indiana trucks in the service of individuals, concerns, corporations, state highway departments and municipalities. This book is well illustrated and contains some interesting material which contractors and municipal officials will be glad to have.

STURDY TRUCKS FOR ROAD BUILDERS

Road Builder trucks are helping contractors to lay more miles per day at a greatly reduced cost of hauling materials because of their speed, power, short turning radius, ease of operation, dependability and unusually low operating cost. Further details regarding these trucks may be secured from the Ruzgles Motor Truck Co., Saginaw, Mich.

CAST STONE BLOCK MACHINERY

The Zagselmeyer system of casting plain and granite faced concrete building blocks as well as concrete brick is completely described in a well-illustrated 46-page booklet which can be secured gratis from the Zagselmeyer Cast Stone Block Machinery Co., Bay City, Mich.

WIRE FABRIC FOR REINFORCING CONCRETE

The public at large wants more and better roads with the best reinforcing, which makes for a saving in maintenance costs. Facts concerning wire fabric reinforcement which assures complete protection against cracks and breakage may be secured from the American Steel & Wire Co., 208 South La Salle St., Chicago, Ill.

Unit Construction an Original Link-Belt Idea

Unit Construction Originated by
Us in 1910



Note

the inherent strength and simplicity of Lower Frame and Crawler mechanism—the large roller path and 84-in. pitch diameter rotating

gear ring, eliminate unnecessary "rocking" of rotating frame when handling heavy loads—this reduces stresses. Note also the absence of any riveted or bolted structural members, which cause so much trouble and expense in the ordinary design of lower frame. Full details in Book No. 895.

LINK-BELT COMPANY

2921

Leading Manufacturers of Elevating, Conveying and Power Transmission Chains and Machinery
CHICAGO, 300 W. Pershing Road

Offices in Principal Cities

LINK-BELT

"Built for Service"

CRAWLER

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A CATALOG ON MOTOR GRADERS

Catalog No. 5, which has recently been issued by the Austin Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill., describes the new Austin motor grader powered with McCormick-Deering tractors, which have sufficient weight and power to do reconstruction as well as maintenance work.

A QUICK-DUMPING TRUCK BODY

Bulletin 303 recently issued by the Easton Car and Construction Co., Easton, Pa., completely describes Rapidump and Rollover bodies in 1 and 1½ cubic yard sizes, excellent for contracting service. Reductions in prices on these bodies were effective December 1, 1926.

A NEW ONE-MAN GAS OR ELECTRIC SHOVEL

The new Fumond shovel operated by gasoline or electric motor, which is designed and built to meet the demand of modern excavating practice for a simple, small shovel, and which operates economically, is illustrated and completely described in the literature of the Fumond Hoist and Shovel Co., Lima, Ohio.

TWO-CYLINDER AUTO-TYPE ENGINES FOR CONTRACTORS

The Alamo gas engine which provides a light compact power plant for contractors for the operation of concrete mixers, saw rigs, derricks, etc., is completely described in Bulletin 54-4 which may be secured from the Alamo Engine Co., Hillsdale, Mich.

DOUBLE-ACTION CONCRETE FINISHING TOOLS

Abram double-action finishing tools, which consist of high-grade steel tools that can be operated by a man from standing position and which do not require experienced operators, are completely described in the catalog of the Abram Cement Tool Co., 2300 Michigan Ave., Detroit, Mich.

DIRECT-DRIVE CONCRETE MIXERS

The Rammel Mfg. Co., Kewaskum, Wis., will be pleased to send a copy of its illustrated 18-page booklet on Rammel direct-drive chainless concrete mixers with locking tilting mechanism, to any contractors interested.

A TRACTOR SHOVEL WITH A PEDIGREE

The Bay City 16-B tractor shovel, which operates as a shovel, clamshell, dragline or crane, with ¾-yard bucket, struck measure, is described completely in the literature of the Bay City Dredge Works, Bay City, Mich.

HIGH-GRADE COMPRESSOR EQUIPMENT AT A LOW PRICE

Full information about the Curtis portable compressor, powered and propelled by the Fordson tractor for all kinds of work requiring compressed air, and which is remarkably economical in operation and low in price, may be secured from the Curtis Pneumatic Machinery Co., 1931 Kienlen Ave., St. Louis, Mo.

FLAKE GRAPHITE AS A LUBRICANT

Coarse or powdered flake graphite, an ideal natural lubricant recommended for cylinders and bearings, coating gas engines, etc., is described in Circular 148-C issued by the Joseph Dixon Crucible Co., Jersey City, N. J.

TWO EXCAVATORS FOR THE PRICE OF ONE

Inslay excavators, two of which can be purchased for the price of one large machine and which can handle a great volume of basement and cellar excavation, curb and gutter work, street and alley grading, etc., are described in Catalog 51 issued by the Inslay Manufacturing Co., Indianapolis, Ind.

FOLDING ALUMINUM RULES

Lufkin folding aluminum rules in tenths and hundredths of feet, for civil engineers, contractors, surveyors, highway builders, tile layers, etc., and which are accurate, light-weight, durable and rust-proof, are described in a folder which may be secured from the Lufkin Rule Co., Saginaw, Mich.

BEDROCK FACTS ON CONCRETE

It is best for every contractor or municipal official to know absolutely the quality of concrete going into every job. Bulletin No. 26 issued by the Pittsburgh Testing Laboratory, Pittsburgh, Pa., describes P.T.L. service, which is today nationally recognized by municipal engineers and officials.

CRANES THAT BRING REPEAT ORDERS

The Speeder Machinery Corp., Cedar Rapids, Iowa, manufacturers of Speeder shovels and cranes, which operate with shovel, pull-shovel, crane and dragline attachments. The sale of the first Speeder shovel to a contractor brings repeat orders. These shovels and cranes are described completely in literature furnished free by the manufacturers.

A WHEELBARROW TO STANDARDIZE ON

The Sterling wheelbarrow, on which many contractors have standardized and which is so built as to give easy wheeling and has a strong wheel with malleable brackets keyed to the axle and ten spokes flush riveted, is described in the literature of the Sterling Wheelbarrow Co., Milwaukee, Wis.

PAVEMENT THAT DELIVERS SERVICE

Warren Brothers Co., Boston, Mass., makers of Warrenite-Bitulithic pavement will be pleased to furnish literature on this type of pavement to any contractors wherever a high-grade bituminous pavement is being considered for city or rural highway.

ROAD OR CONTRACTORS' PLOW

The "3 in 1" road or contractors' plow, which is intended for use with animal power, traction engine, road roller, dragline or other power and which weighs, with clevis, 315 pounds, is described fully in a booklet which may be secured by writing to S. J. Hunt, Sales Manager, Wiard Plow Co., Batavia, N. Y.

TIGHT PIPE JOINTS WITHOUT LEAD OR SUBSTITUTES

A pipe for water-supply and fire protection, which eliminates all jointing materials and equipment, saves the cost of digging bell-holes and which will not work loose, yet is dependable and flexible, is described in the Universal cast iron pipe literature of the Central Foundry Co., 41 East 42nd Street, New York.

A NEW MIXER CATALOG

The new 1927 Jaeger catalog on non-tilting and plaster mixers has just been issued and may be secured from the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio, by any contractors interested in efficient mixing and the new automatic skip shaker for loading skips or hoppers.

A ½-YARD SHOVEL CRANE THAT DOES THE JOB

The Mead-Morrison Mfg. Co., 148 Prescott St., Boston, Mass., will be pleased to send to anyone interested its Bulletin No. 131 describing the Mead-Morrison ½-yard shovel crane, which has full-circle swing, automatic brakes, simplified control, live boom and a powerful cable crowd for one man operation.

A UTILITARIAN EXCAVATOR

The General excavator, claimed to be the master tool for every excavating purpose, which has a full ½-yard capacity, is convertible in the field to a crane, dragline, ditcher, trencher, skimmer or backfiller, and which uses either electric motor or gasoline engine delivering 45 horsepower at 1,000 r.p.m., is described completely in the latest literature of the General Excavator Company, Marion, Ohio.

WIRE ROPE THAT IS STANDARD EQUIPMENT

Williamsport Telfax tape-marked, factory certified, wire rope is standard equipment on the best made contractors' machinery. Contractors who believe in using the right grade of rope are always sure when they purchase Williamsport Telfax rope. Full information may be secured from the Williamsport Wire Rope Co., Peoples Gas Bldg., Chicago, Ill.

A DENSIFIED MINERAL OIL FOR CRAWLER TRACTORS

Dixoyl, a scientifically densified mineral oil, insuring 100 per cent lubrication in extremes of heat or pressure, in cold, in water or steam, and which is made in five densities for use wherever heavy-bodied oil is required, is made by Dixoyl, Inc., Vandeventer and Duncan Ave., St. Louis, Mo. Complete information regarding its use, as well as prices, may be secured from the manufacturers.

A GAS ENGINE WITH WIDE SPEED RANGE

The Denison Powermakel, an engine with the crankshaft on top and which has a wide variation in speed range and is built compactly for use with concrete mixers, hoists, centrifugal pumps, triplex or force pumps, diaphragm pumps, air-compressors, conveyors, unloaders, etc., and other equipment requiring up to ten horsepower is described in the literature of the Cook Motor Co., Delaware, Ohio.

A SPEEDY CRANE FOR HANDLING MATERIALS

The Moore Speedcrane, which is convertible into a shovel, trench hoe or dragline and is furnished with gas, steam or electric power in ¾- and 1-yard capacities with 35- to 50-foot booms, is completely described in worth-while illustrated literature of the Moore Speedcrane Co., 33 South La Salle St., Chicago, Ill.

A SHOVEL CRANE THAT HAS MET EVERY PROMISE

The Lorain-75, mounted on the center-drive truck and manufactured and sold by the Thew Shovel Co., Lorain, Ohio, came through last year with every promise more than fulfilled, and expects to set a new pace for shovel and crane performance in 1927. A complete description of this machine and its service may be secured from the company.

THE MANUFACTURE AND USE OF RELIABLE PORTLAND CEMENT

The Pennsylvania-Dixie Cement Corp., 131 East 46th St., New York, will be pleased to furnish to any contractors interested, its 36-page illustrated booklet, which contains a representative collection of concrete construction views and completed projects in which Pennsylvania-Dixie Cement plays an important part.

KOEHRING

Action!



SMOOTH action! Swift action! Responsive and eager! Actually there seems to be a striving, capable earnestness in the crane itself to give you a bigger day's work! If anything mechanical can be said to have *personality*—the Koehring has it!

Of course it's just a result of perfected design and thorough workmanship! *Strictly internal combustion engine design* in every gear and detail—that's one reason for its remarkable swift, smooth responsiveness!

Finger-tip ease of control—that's another reason for its big day's work! In countless details of design and construction, the Koehring is a machine of smoother, more responsive, more eager, faster action!

Stand at the control levers—you'll see and feel what words can never picture!

Know the Koehring. Send for Bulletin No. Cr. 6

Crane Capacities

No. 1—1 cu. yd. clamshell bucket on 60 ft. boom or 1/4 cu. yd. on 45 ft. boom. Lifting capacity, 10 tons at 12 ft. radius. 4 cylinder, 5 1/2 hp. in. gasoline engine, 1000 R. P. M.

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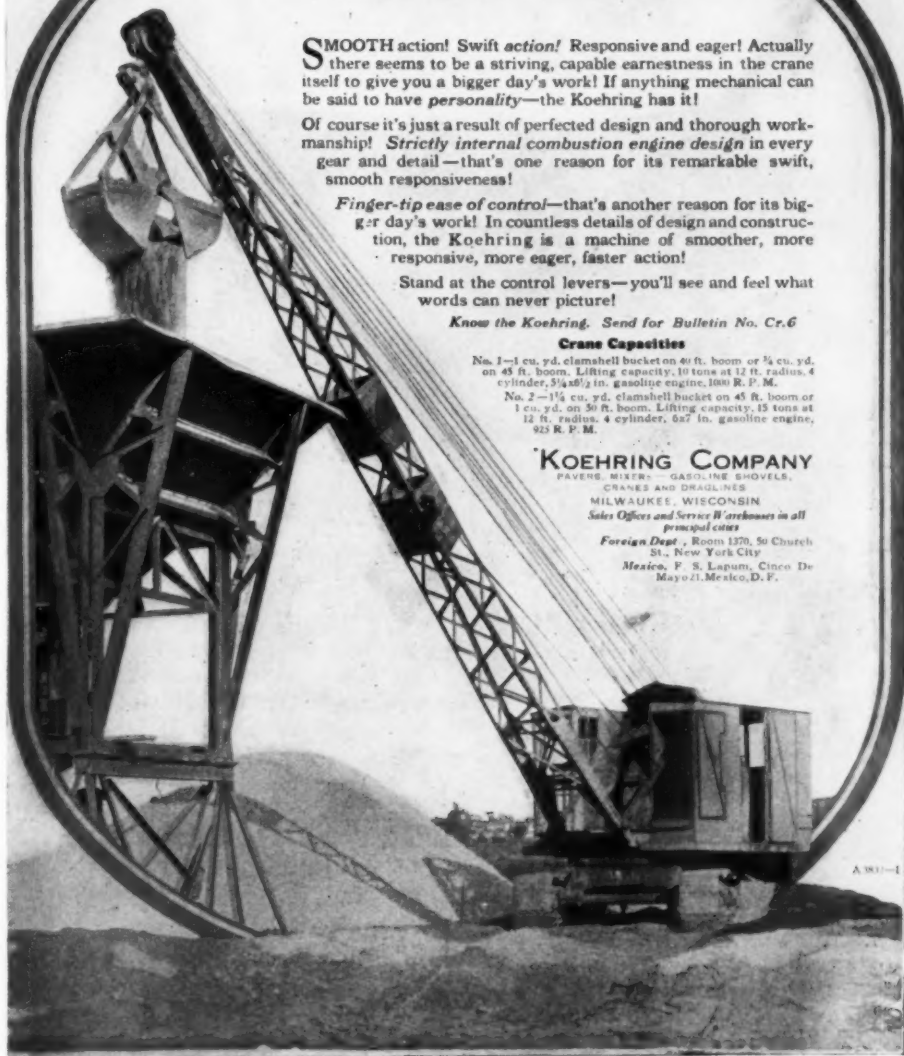
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ROME Graders were designed to meet the new conditions and factors such as adequate weight, proper balance, strength of materials and parts, ease of handling and operation. were given careful consideration.

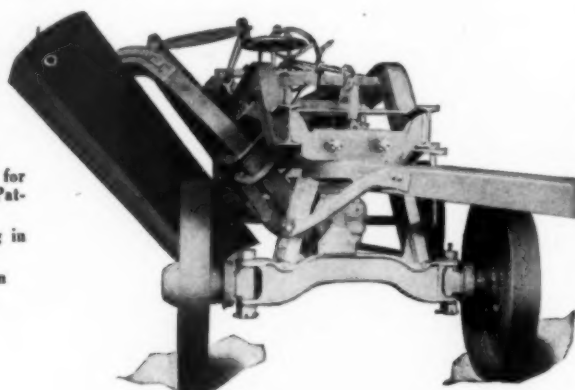
Weight and balance are prime necessities if graders are to work surely and effectively when pushed or pulled by tractor power.

Materials and parts must be adequate to stand the stresses and strains that are set up. Great care is here used in the assembling of ROME Graders.

As graders are made larger and heavier a most important consideration is simplicity of parts and ease of operation. A glance at a Rome Grader will show its clean lines and comparatively few parts.

SPECIAL

High lift of Blade for
Bank Sloping (Pat-
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Cut Gears running in
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FEATURES

Steering Gear knuckle
and spindle type (Pat-
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Disc Wheels, concave
(Patented)
Timken Bearings

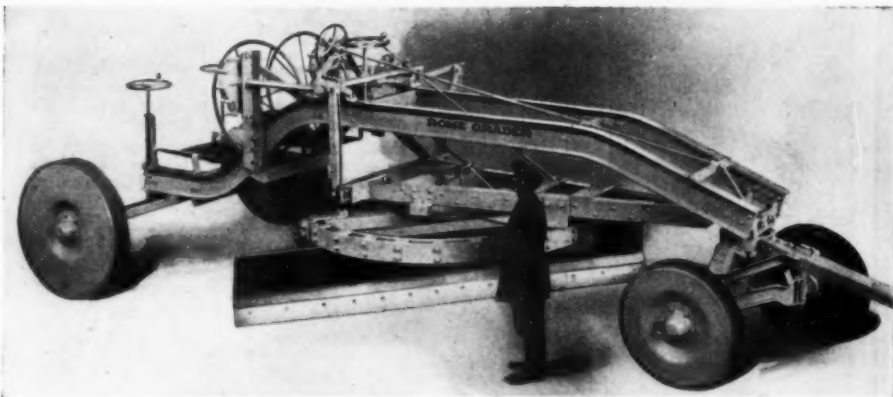
ECONOMY
vs.
EXTRAVAGANCE

The design and construction of ROME Graders are such that large amounts of earth can be moved with rapidity and ease. This to the road builder is a dollar-making proposition. Day after day Rome graders will pay back big dividends on the original investment. **BEWARE OF THE EXTRAVAGANCE OF USING OLD OR POORLY BUILT EQUIPMENT.**

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The extreme operation of the controls on the Rome grader is an exclusive feature and is obtained—by accurate machining of worms and worm wheels, thus doing away with lost motion—by use of Timken roller thrust bearings on all worms including steering gear and pivot bearing of circle or mould board center, and by complete Alemite lubrication. All gears have cut teeth and are enclosed in oil tight gear cases running in a bath of oil. Worm screws are hammered forgings with cut teeth.

The "High Lift" permits adjustment of the mould board to obtain either a 1 to 1, or 1 to 1½ slope, thus making a bank sloper without additional cost or attachments. With the ROME grader it is not necessary for the operator to leave his platform; in a very short space of time, he can set the machine in a sloping position and do this additional work quickly and efficiently.

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The disc wheels are a new and patented feature. They are made from ¼-in. steel boiler plate and properly concaved for strength. This construction in ditching not only holds the grader in line, but trowels the outer bank instead of tearing it away and roughening it.

The rear axle of the Rome Grader is pivoted, which adds greatly to the efficiency of the machine and permits road operation that would be impossible or difficult without such a device. Vertical steel disc wheels in combination with a pivoting rear axle makes for the most practical, efficient and economical operation.

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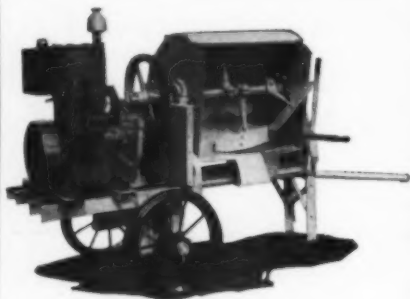
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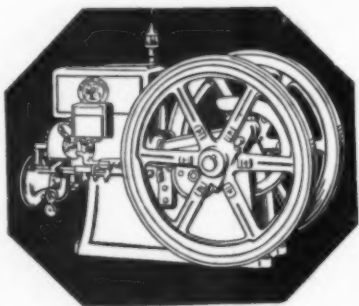
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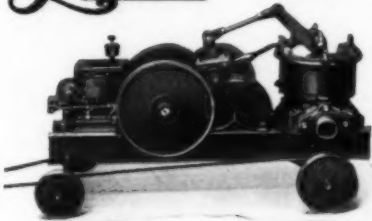
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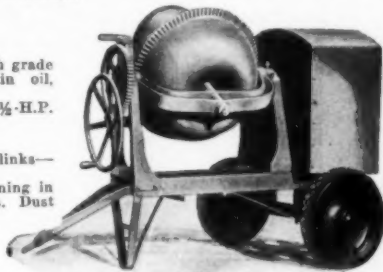
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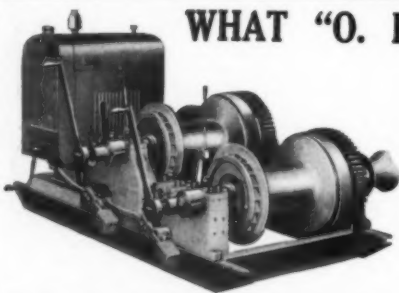
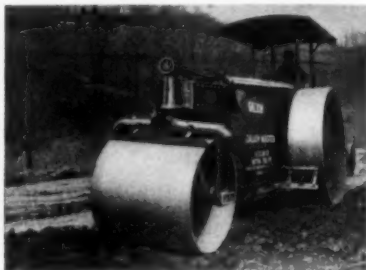
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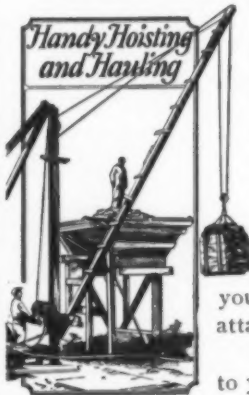
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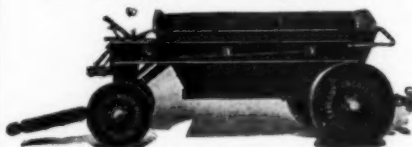


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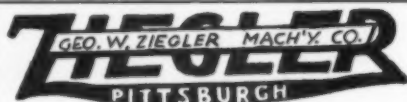
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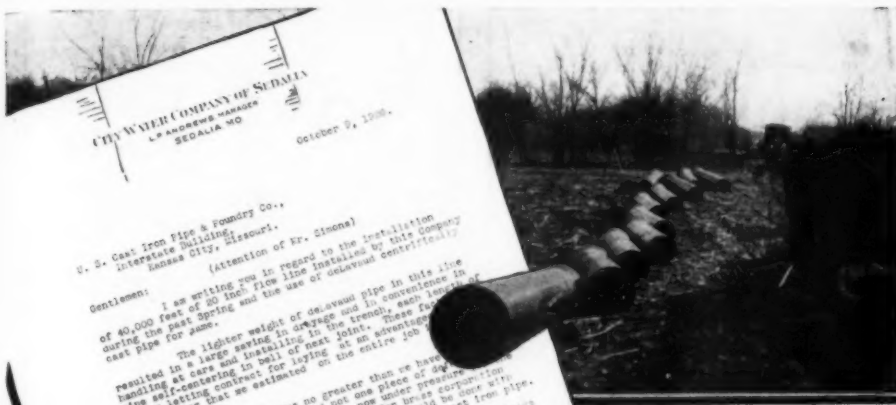
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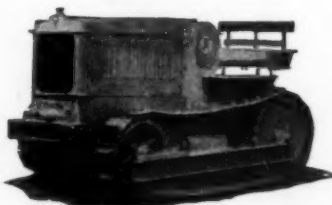
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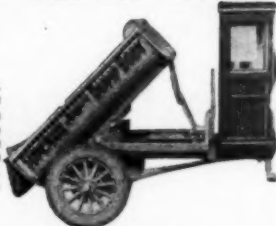
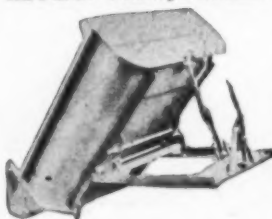
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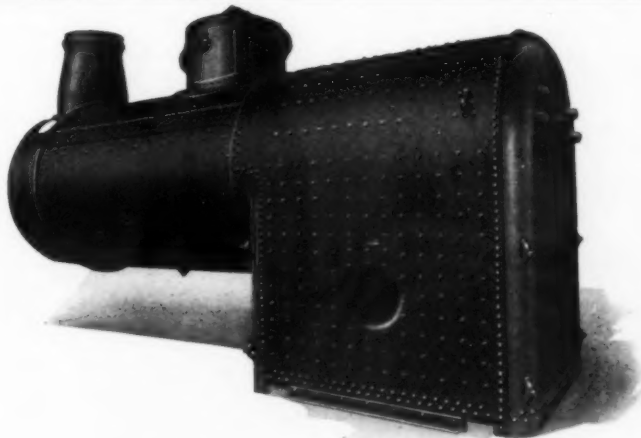
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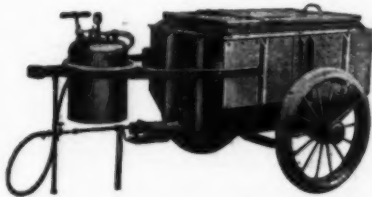
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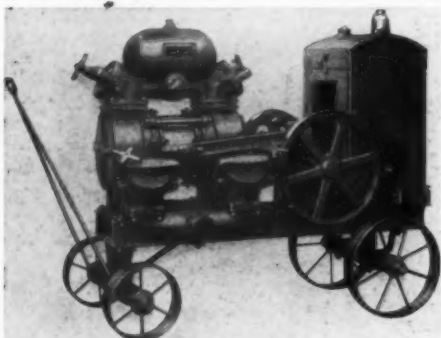
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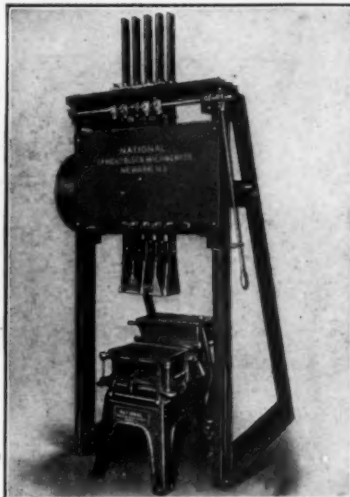


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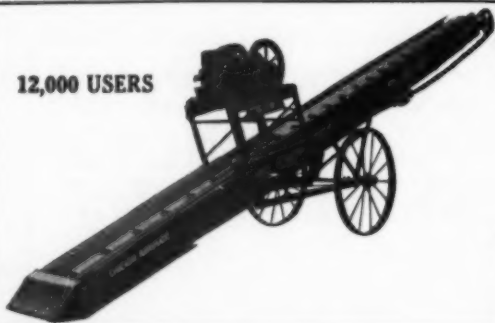


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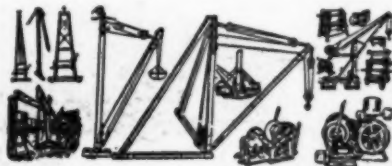


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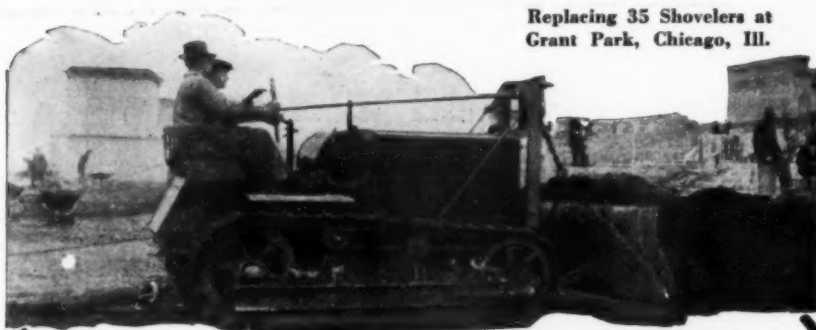
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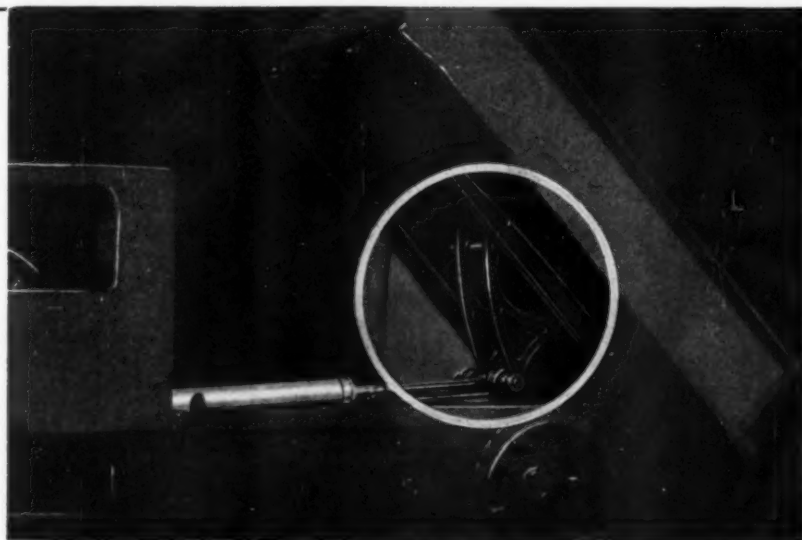
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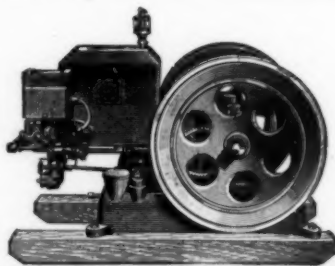
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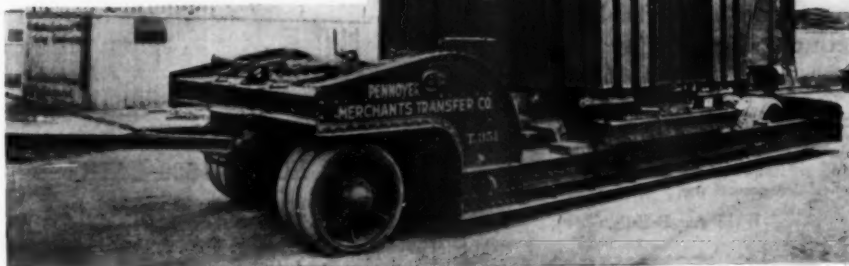
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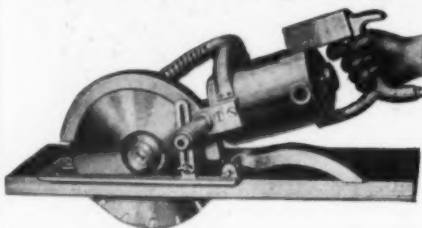
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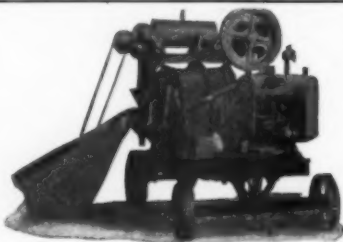
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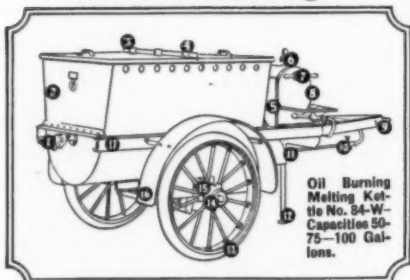
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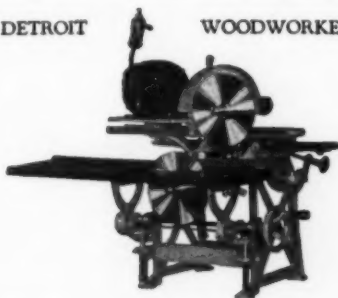
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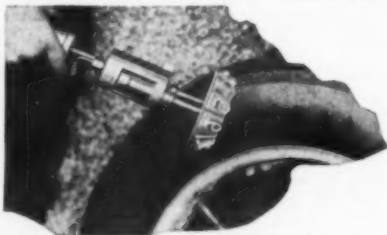
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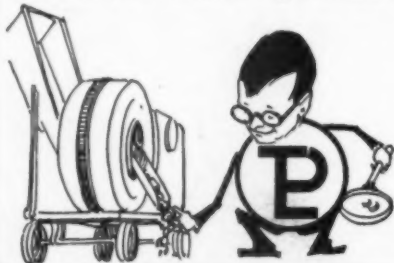
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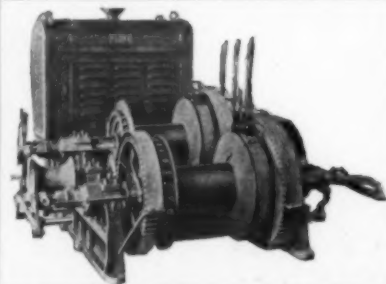
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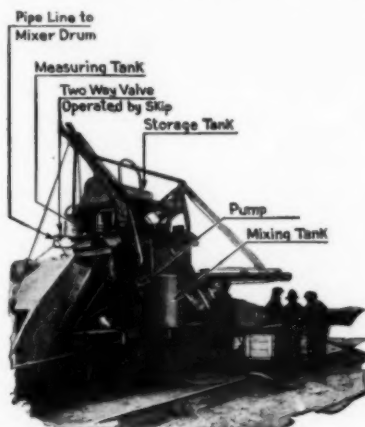
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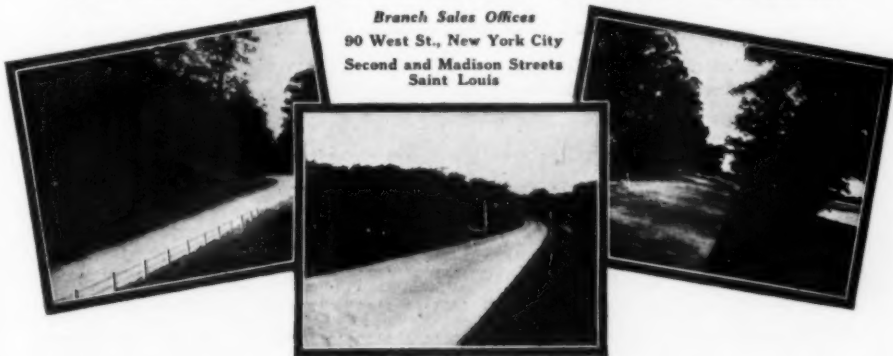
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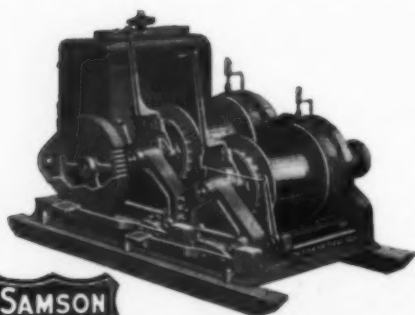
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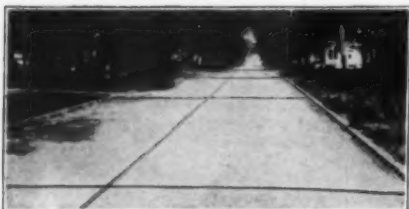
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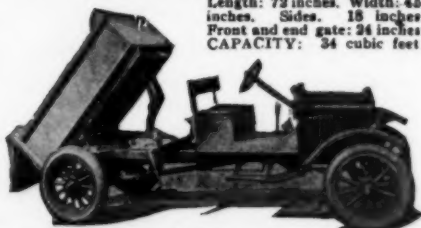


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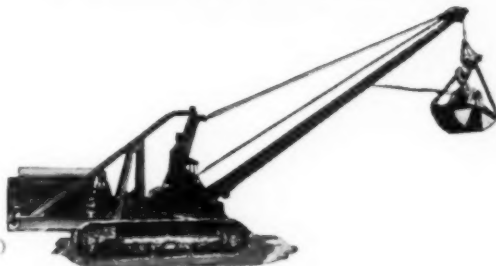


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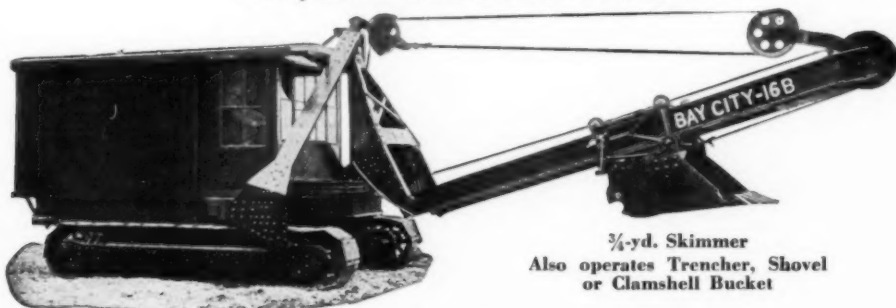
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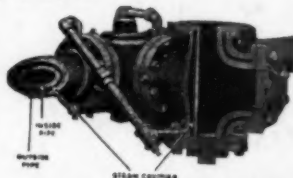
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